NUTA-A
26 January 1999

Total Pages: 198

NATIONAL IMAGERY AND MAPPING AGENCY (NIMA)

UNITED STATES IMAGERY AND GEOSPATIAL INFORMATION SYSTEM (USIGS)

USIGS TECHNICAL ARCHITECTURE (UTA)

REVISION A

26 January 1999

This Page Intentionally Left Blank

PREFACE

This document was prepared by the National Imagery and Mapping Agency (NIMA), Systems Engineering & Integration Division (SOS). The purpose of this document is to define the United States Imagery and Geospatial Information System (USIGS) Technical Architecture (UTA). The UTA:

- profiles the Department of Defense (DoD) Joint Technical Architecture (JTA) Version 2.0 for the Imagery & Geospatial Community;
- presents a framework that details imagery and geospatial services and emphasizes the distributed object computing approach of the USIGS architecture;
- provides a standards-based technology forecast;
- promulgates guidance to the IGC in matters promoting interoperability and the use of common standards among USIGS systems.

This is Revision A of the UTA. It supersedes the original issue of the UTA dated 6 November 1997. Changes made in this revision include the following:

- Mandated and emerging standards are incorporated within each architecture service area, rather than split into separate sections; this organization gives a clearer picture of how each set of standards is evolving.
- The profiling relationship with the JTA is spelled out more clearly, by specifying the UTA standards that change or add to JTA standards.
- The term Mission Specific Application (MSA) has been changed to Mission Area Application (MAA) to be consistent with the DoD Technical Reference Model (TRM). In addition, some of the MAA category names have been changed.
- An Addendum has been added that provides a compliance checklist and a complete, self-contained list of UTA standards and specifications (both those incorporated from the JTA and those added from industry sources).

Please refer questions or comments to:

National Imagery and Mapping Agency
Systems Engineering & Integration Division (SOS)
Engineering Branch (SOSE)
Standards & Interoperability
Attention: J. Wesdock
Phone: 703-808-0739
Email: WesdockJ@nima.mil

LIST OF EFFECTIVE PAGES

Holders of this document will verify the pages herein comply by page number and date with those indicated below.

Page	Date	Page	Date
All	26 January 1999		

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

TBD/TBR LOG

PARAGRAPH	PAGE	TBD	TBR	DESCRIPTION
(None)				

1. Introduction

1.1 Purpose

The purpose of this document is to define the United States Imagery and Geospatial Information System (USIGS) Technical Architecture (UTA) view for the Imagery & Geospatial Community (IGC). Key documents in the definition and use of the UTA include the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Architecture Framework [C4ISR97], the USIGS Architecture Framework (UAF) [UAF98], and the Department of Defense (DoD) Joint Technical Architecture (JTA) [JTA98].

The USIGS is the extensive network of systems used by the Department of Defense (DoD) and the Intelligence Community that share and exploit imagery, imagery intelligence, and geospatial information. These systems provide capabilities involved with the integrated information management, collection, production, exploitation, dissemination and archive, and infrastructure of this information. Organizations which have some level of interface with USIGS, but are not part of DoD and the Intelligence Community, are considered participants in USIGS if they adhere to the technical and system standards [NSP97].

The IGC is the composition of cooperating commands, services, agencies, and departments within the United States Government, foreign governments, and private sector organizations involved in the acquisition, production and exploitation, and dissemination of imagery, imagery intelligence, and geospatial information. The IGC fosters extensive partnerships with others, including commercial and academic institutions, to collaboratively work together to share information [NSP97]. The IGC represents a domain of specialization and a corresponding community of specialists that cut across organizational boundaries. The scope of this domain is the union of these areas of specialization: mapping, charting, geodesy, imagery, and imagery intelligence. In this document, this collection of areas of specialization will be referred to as MCG&I (mapping, charting, geodesy, and imagery).

The UTA has the following interrelated goals:

- Establish a set of information technology (IT) standards, conventions, and guidelines applicable to new and migration USIGS system development, and application component development, in support of the IGC.
- Profile the DoD Joint Technical Architecture (JTA) Version 2.0 for the IGC.
- Promote the use of open, commercial standards in USIGS; these standards will affect the selection of Commercial Off-The-Shelf (COTS) hardware and software products by IGC acquisition personnel.
- Provide an open distributed computing model for the development and operation of the USIGS.
- Support interoperability across the USIGS community by focusing on common information technology services and open interfaces among USIGS systems and components.
- Provide input to the USIGS Interoperability Profile (UIP) [UIP98].

- Provide a standards-based technology forecast that USIGS PEOs, Program Managers, and acquisition personnel can use in the acquisition and development of new USIGS systems as well as in system migration initiatives.
- Mutually influence and aid integration with the USIGS System and Operational Architectures and the USIGS Conceptual Data Model (USIGS/CDM).

1.2 Scope of the UTA

The scope of the UTA is the set of information technology (IT) and IT-related services and interfaces that support the IGC in the development and maintenance of the USIGS. These IT services and interfaces, grouped into functional areas, are defined by standards, specifications, conventions and guidelines. The UTA includes MCG&I services, interfaces, and USIGS unique specifications, as well as more general, commercial IT services and interfaces.

Documents superseded. This revision of the UTA supersedes all earlier technical architecture and standards mandates provided in the following documents:

- NIMA USIGS Technical Architecture (first issue), 6 November 1997 (NIMA S1020100) [UTA97]
- USIS Standards & Guidelines, Version 1.0, 13 Oct 1995 (CIO 2008) [USIS95]
- USIS Standards Profile for Imagery Distribution (SPID), Version 1, 13 October 1995 [SPID95]
- Defense Mapping Agency, Technical Architecture Framework and Implementation Guidance (TAFIG), Version 1.0, 28 Oct 1994 [TAFIG94]

1.2.1 Applicability of the UTA

1.2.1.1 Acquisition Activities

The UTA identifies and defines information technology standards, services, and their interfaces, which must be incorporated into USIGS systems to support interoperability requirements. *The UTA will be a compliance document on all new USIGS development programs placed on contract after 26 January 1999, the publish date of this document.* For new acquisitions, it is expected that Program Managers will build the appropriate standards compliance requirements into their program baseline from the start.

Migration systems (existing systems that are expected to still be in service after FY2005) will be individually evaluated to determine which UTA standards apply to them and when they must be modified to achieve UTA compliance.

In general, legacy systems (existing systems with a life-span not expected to exceed FY2005) will not be retrofitted for the sole purpose of achieving UTA compliance.

System-specific standards profiles will be created for all new and migration systems and added as appendices to future versions of the UTA. These profiles will be used to support program funding and scheduling decisions and to develop a time-phased migration path to full UTA compliance. The standards profiles will provide NIMA with a means of overseeing and guiding standards implementation in system requirements development, analysis, design, development, and fielding.

1.2.1.2 Organizations

Many organizations, including but not limited to the list in Table 1-1, are considered part of the USIGS community to the extent that they produce, provide, or exchange MCG&I information. DoD Directive 5105.60 [NIMA96] designates the Director, NIMA, as the functional manager for imagery, imagery intelligence, and geospatial investment activities. NIMA has the responsibility of prescribing and mandating standards and technical architectures for MCG&I information for the DoD and the non-DoD elements of the Intelligence Community. This responsibility makes NIMA a key component of the USIGS. Other DoD/government stakeholders assist in the collaboration and co-production of MCG&I data in their specific functional area. International partners assist in the collaboration and co-production in their specific regional area. This information and USIGS data are shared, under formal agreements. International standards bodies such the International Organization for Standardization (ISO) define many of the standards specified for USIGS in this document and in the JTA.

Industry participation in the USIGS community is represented primarily by two consortia who contribute relevant technology and specifications: the Open GIS Consortium, Inc. (OGC) and the Object Management Group (OMG).

- The Open GIS Consortium, Inc. (OGC) provides industry-specific direction and products within the IGC. The primary interest of this consortium is to promote the development of open system approaches to geoprocessing, including technologies and standards that integrate geoprocessing with distributed architectures.
- The Object Management Group (OMG) provides distributed object computing technology based on the Object Management Architecture [OMG97].

Table 1-1. USIGS Stakeholder Organizations

DoD	Other Government		International	Industry
Commands	CIA	DoI	Agreements with 114 countries	OGC
DIA	DoC	DoT	and political entities	OMG
NIMA	DoE	FEMA	Standards bodies (e.g., ISO)	
JTFs	DoJ	EPA		
NSA	NRO	NASA		
OSD	State Dept.	USDA		
Services	Treasury Dept.	USGS		

Figure 1-1 shows the applicability of systems in various types of organizations to the JTA and USIGS. Each organization that is a stakeholder in USIGS is assumed to have systems that are covered by the UTA, and other (non-USIGS) systems outside the scope of the UTA. Other non-DoD organizations also do not typically have a mandate to follow the JTA.

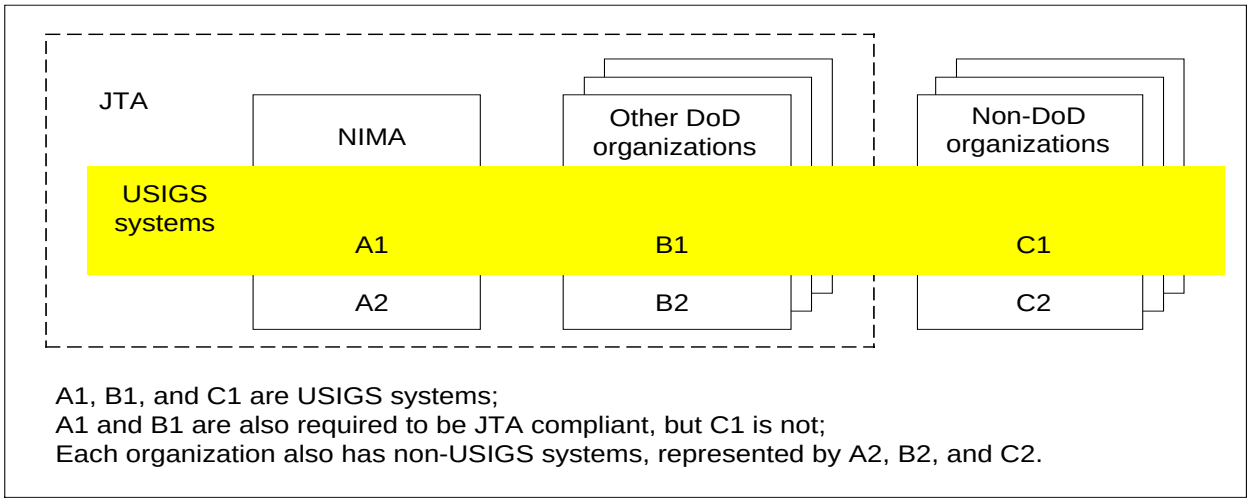


Figure 1-1. UTA Applicability to Systems in Organizations

1.2.2 Context

1.2.2.1 Architecture Framework

Architectures define the structure of components, their relationships, and the principles and guidelines governing their design and evolution over time. The USIGS Architecture Framework document [UAF98] discusses the USIGS architecture components, their roles and relationships, and identifies architecture documentation that needs to be developed to define and evolve an integrated, interoperable USIGS. The USIGS architecture components are based on the C4ISR Architecture Framework 2.0 [C4ISR97].

The interrelated set of USIGS architecture components include the Operational Architecture, the Technical Architecture, the System Architecture, and the Conceptual Data Model (CDM). The USIGS Operational Architecture documentation identifies operational elements, activities, and information flows. The USIGS Technical Architecture (UTA) provides applicable standards and conventions that govern systems implementation and operation. USIGS System Architecture documentation overlays system capabilities onto requirements and identified standards to provide a map of current and future capabilities. The USIGS/CDM provides the common data modeling and terminology baseline needed to articulate and integrate the other component architecture views. An overview of USIGS architecture components is shown in Figure 1-2.

A *technical architecture view* is a minimal set of rules governing the arrangement, interaction, and interdependence of the parts or elements whose purpose is to ensure that a conformant system satisfies a specified set of requirements. The technical architecture identifies the services, interfaces, standards, and their relationships. It provides the technical guidelines for implementation of systems upon which engineering specifications are based, common building blocks are built, and product lines are developed [C4ISR97].

The USIGS architecture is aimed at implementing the vision stated in the NIMA Business Plan [NBP97]. The NIMA Business Plan drives the USIGS Operational Architecture, which in turn affects the USIGS Technical and System Architectures.

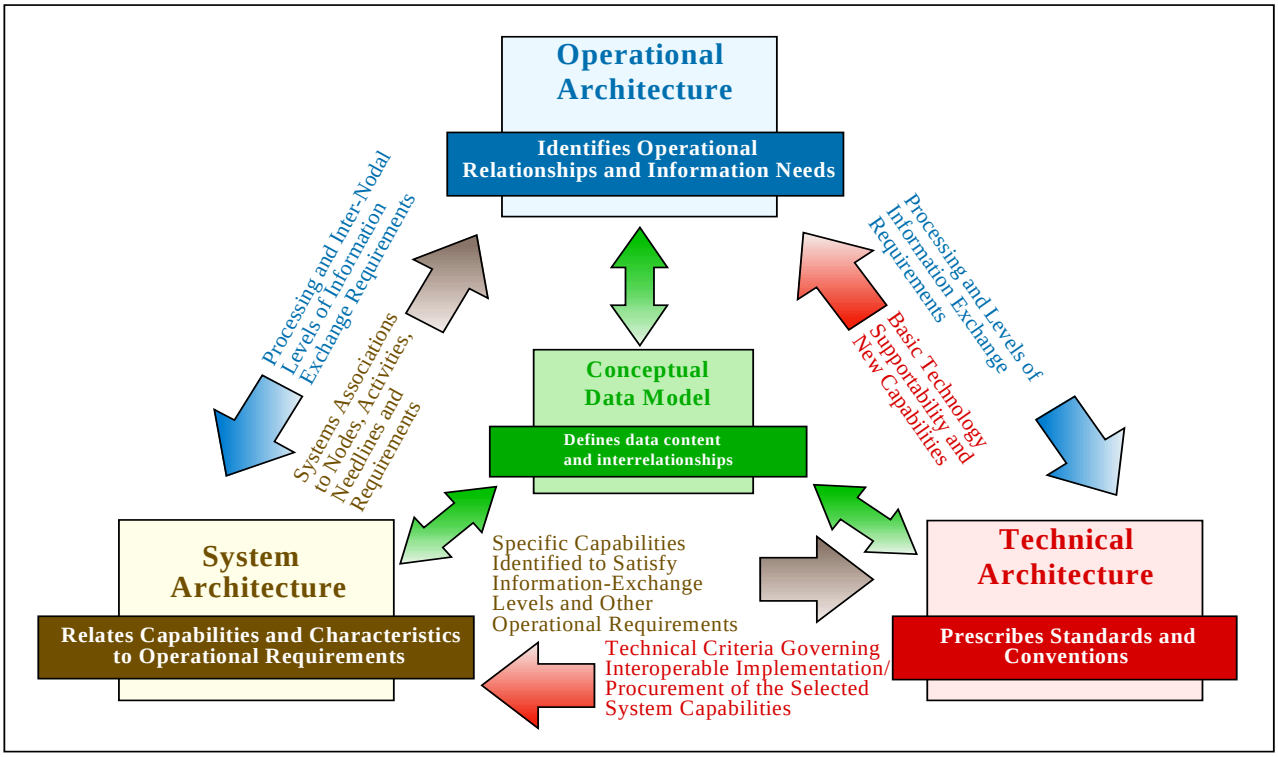
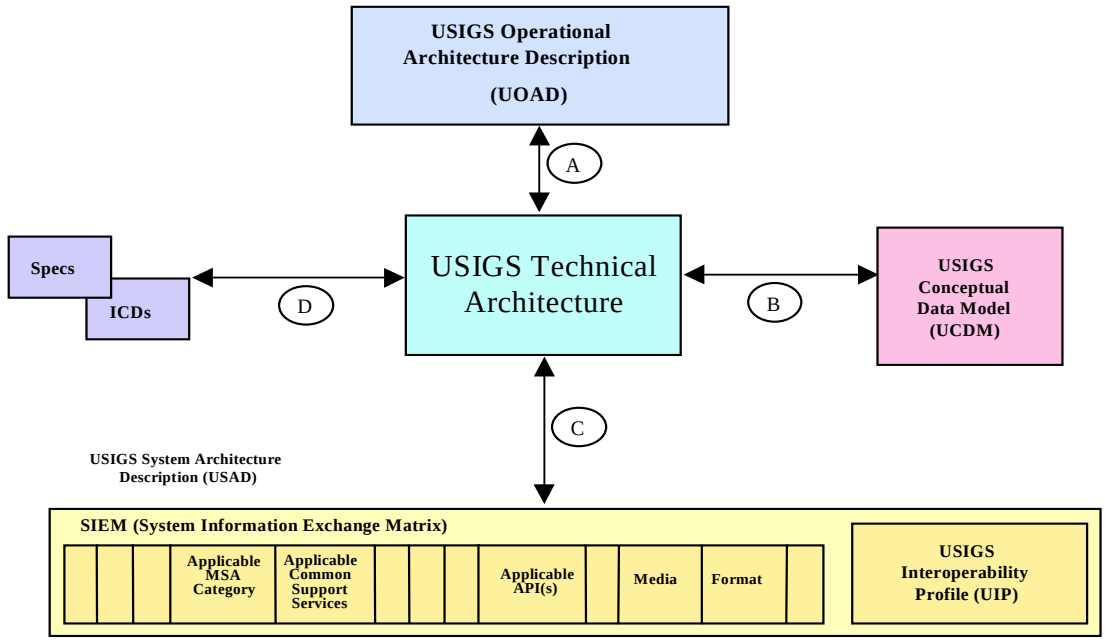


Figure 1-2. USIGS Architecture Components (from [UAF98])

The technical architecture view influences other architectural components and also reflects the software strategy of the overall architecture. The emerging technologies will be a factor in the USIGS Operational Architecture in deriving the business changes based upon those technology implementations. The UTA is a key element in the operational architecture vision. In turn, the UTA is dependent upon the other architectural components. The USIGS Operational Architecture will influence the development and design of software components and applications with input from the legacy and migration components of the system architecture to leverage current software investments. The USIGS "to be" System Architecture (Volume 1) will be driven by the standards selected and identified by the UTA and will be included in specific migration plans and products. The migration plans will also include standards development needed for the specifications of services common within USIGS. In addition, the USIGS/CDM provides data standards cited within the UTA. The linkages between the UTA and other parts of the architecture are illustrated in Figure 1-3.



A) The UOAD identifies requirements for which services must be provided. The UTA identifies the standards specifications that are necessary to satisfy those requirements.

B) The UTA mandates the use of the USIGS Conceptual Data Model (USIGS/CDM), which standardizes data element usage in the USIGS.

C) The UTA identifies the Mission Specific Application categories, the MCG&I services, common facilities, distributed computing services, and other platform services for the System Architecture. These applications and services will be used to build the System Architecture Functional Components. The applications and services are also mapped to the Operations Activities identified in the USIGS Operational Architecture. The USIGS Interoperability Profile (UIP) [UIP98] defines the profile for software interface standards to be used to achieve interoperability between multiple clients and servers within the USIGS. The UIP profiles applicable standards and specifications to specific USIGS system components, and this level of detail provides the basis for evaluating compliance. This is a key link between the USIGS Technical Architecture and System Architecture.

D) The UTA identifies: 1) applicable formal standards specifications, 2) USIGS-specific specifications, and 3) guidance concerning legacy standards that may be in the form of Interface Control Documents (ICDs) or other forms of specification.

Figure 1-3. Technical Architecture Relationships

1.2.2.2 Relationship to the DoD Joint Technical Architecture

The DoD JTA, Version 2.0, provides the core of the standards content for the USIGS Technical Architecture. The JTA provides a set of common, open information technology (IT) standards. These standards provide part of the DoD Technical Architecture as defined in the C4ISR Architecture Framework 2.0. The JTA "defines the service areas, interfaces, and standards (JTA elements) applicable to all DoD systems, and its adoption is mandated for the management, development, and acquisition of new or improved systems throughout DoD." [JTA98]. The standards and guidelines in the JTA are the result of collaboration among the Services, Joint Staff, USD(A&T), ASD(C3I), DISA, DIA, and other elements of the Intelligence Community. While Version 1.0 of the JTA was developed and mandated for use in new or upgraded DoD C4I systems, Version 2.0 is mandated for all DoD Information Technology systems to include C4ISR, Sustainment, Weapon Systems, and Modeling and Simulation. The UTA is a profile (as explained in UTA Section 1.5.1.1) of the JTA for the USIGS community.

1.2.3 Summary of UTA Architectural Context

Figure 1-4 summarizes the architectural context of the UTA. The emphasis in this diagram is on architecture views, as defined in the C4ISR Architecture Framework [C4ISR97] and tailored for USIGS by the USIGS Architecture Framework: Operational, System, and Technical Architectures and the core

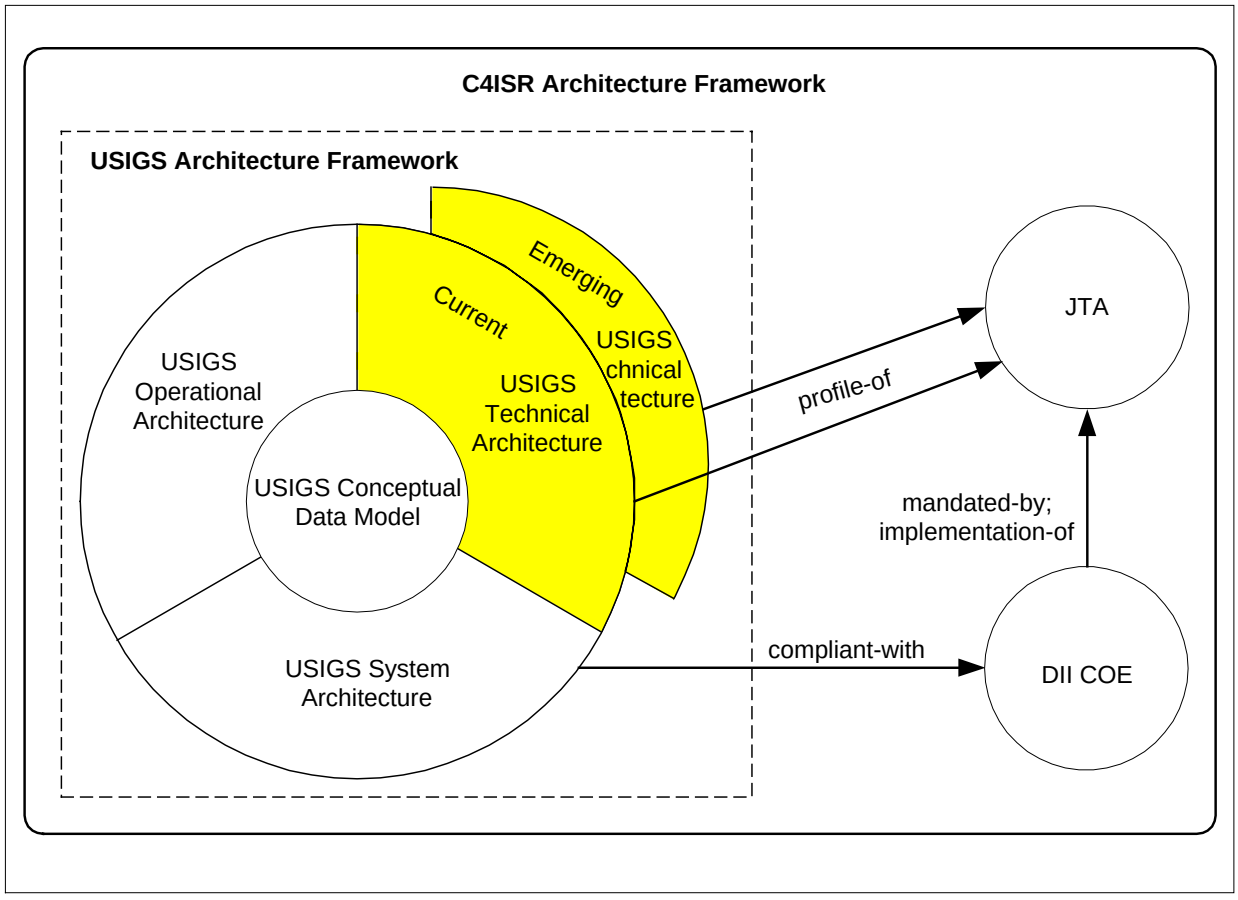


Figure 1-4. UTA Architectural Context

USIGS/CDM that cuts across the other three. The time phasing is shown in the UTA as Current and Emerging. The DoD JTA is the minimum set of information technology standards for use in all new and upgraded DoD information systems. The UTA then profiles the JTA set of standards and specifications for USIGS implementation. In addition, the DII COE is mandated by the JTA as stated in Appendix B of this document. Because the DII COE is an implementation of the JTA, the COE has a more direct influence on the USIGS System Architecture than on the UTA.

1.3 Considerations in Using the UTA

The UTA content is directly linked to the DoD JTA 2.0 [JTA98]. The UTA is intended to be used by anyone involved in the management, development, or acquisition of new or upgraded USIGS elements. USIGS component developers are expected to use the UTA, in conjunction with the JTA, to ensure that new and upgraded systems (and the interfaces to such systems) meet interoperability requirements. USIGS system integrators shall use it to facilitate the integration of existing and new elements within USIGS. Operational requirements developers shall be cognizant of the UTA and the JTA in developing USIGS requirements and functional descriptions.

The UTA is and will remain a "forward-looking" document that will assist in the acquisition and development of USIGS systems. The UTA is NOT a catalog of all information technology standards used within existing NIMA and IGC systems. The UTA Profile mandates information technology standards that should be incorporated in the requirements specifications of new and upgraded USIGS systems.

Standards required to maintain backward compatibility with legacy or migration systems are not mandated in this document, but such standards can be used as necessary, in addition to—not in place of—mandated standards.

UTA Implementation

Specific system implementation of the standards contained in this document is the responsibility of each USIGS program manager. To assist in evaluating implementation of the UTA, a Standards Compliance Checklist is provided in the Addendum to the UTA. This checklist can be used by USIGS program managers, acquisition personnel, and development contractors to gauge compliance with the USIGS Technical Architecture. However, the UTA document does NOT contain specific guidance on implementing the UTA. Please refer to the following USIGS and NIMA documents for additional information on the implementation of the USIGS Architecture:

- Program Implementation Document [PID98]
- NIMA JTA Implementation Plan [NJIP97]
- USIGS Interoperability Profile [UIP98]

1.4 Control and Update of the UTA

Because of the continual development of new information technology and supporting IT standards, the UTA will be revised at reasonable, announced intervals. The document is controlled by the NIMA

Configuration Control Board (NCCB) and administered by the NIMA Systems Engineering & Integration Division (SOS), Engineering Branch (SOSE). The content of UTA, in terms of standards, conventions, and guidelines, is developed in concert with the overall activities and products of the USIGS Architecture Integration Group (AIG). The content is established by coordinating with members of the IGC. The UTA standards will continue to be based on the JTA as it evolves. The UTA Standards Technology Forecast will be updated in concert with the NIMA Technology Office (ST/T).

1.5 Content and Structure of Document

1.5.1 Content

The USIGS Architecture Framework contains a tailored set of USIGS architecture products that has been identified for each Architecture component, as derived from the *C4ISR* approach (see Figure 1-5). These products present architectural information in a consistent way to serve as a foundation for the analysis, definition, and migration of the USIGS Architecture. Note that the UAF expands upon the *C4ISR Architecture Framework* by separating Migration Planning products from the System Architecture.

The Technical Architecture products shown in this figure are the Technical Architecture Profile and Standards Technology Forecast. These products, as well as where each product is included in the UTA, are delineated and described below.

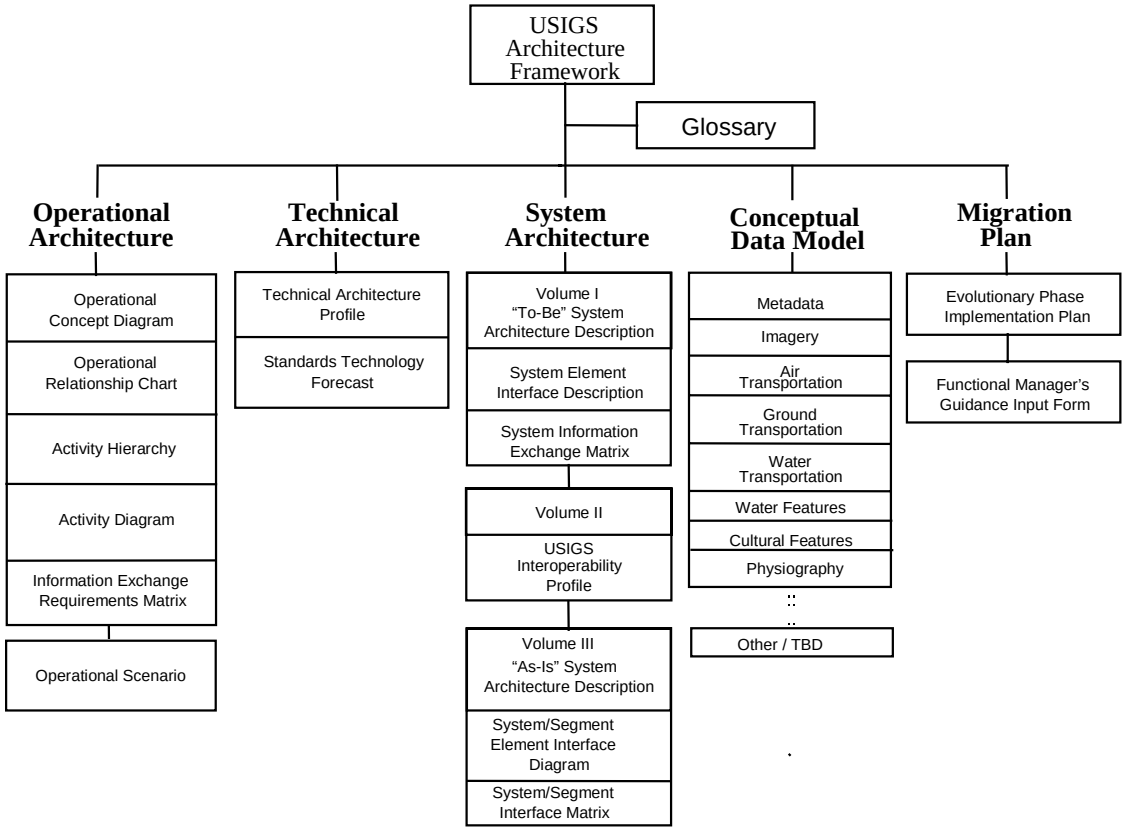


Figure 1-5. USIGS Architecture Products

1.5.1.1 The USIGS Technical Architecture Profile (UTAP)

Technical Reference Model(s) (TRM)

The DoD TRM is extended for the USIGS to show in more detail the necessary support for MCG&I services, and for distributed object computing, as defined by the Object Management Group's (OMG's) Object Management Architecture (OMA). This extended model defines a set of services and interfaces common to the USIGS, and provides the construct to identify where standards are needed and where competing standards exist. The intent is to place the USIGS on a transition path toward a target environment characterized by distributed object computing and open, interoperable systems.

The TRM is addressed in Section 2 of the UTA, and more details of the MCG&I domain services are given in Appendix A.

Mandated Profile of the DoD Joint Technical Architecture

The profile of the DoD JTA is for use by the IGC. Thus, it is the approved list of standards for implementation within the USIGS. The profile is organized by reference model service categories and contains the minimum set of mandatory standards for each service area with which a system must comply if implementing that particular service. The standards profile cites the standards reference, a brief description and status of each standard and any supporting profile.

A standards profile is a set of one or more base standards, and, where applicable, the identification of chosen classes, subsets, options, and parameters of those base standards, necessary for accomplishing a particular function. A standards profile may contain individual standards that may be further defined by separate, authoritative documents, each of which is referred to as a 'profile' or a 'profile of a standard.' Each such profile further refines the implementation of the original standard to ensure interoperability.

The mandated profile is addressed in Sections 3 and 4.

Conventions and Guidelines

Conventions are process or procedure specifications, not formally approved by an accepted standards organization, that describe organizational practices essential to information technology implementation. In the USIGS, conventions are agreed to within the IGC, and—like standards—are mandated in order to maximize interoperability.

Guidelines are recommended, but not required, practices. Whenever possible, USIGS guidelines will be aligned with those from other communities with which the USIGS must interoperate.

Conventions and guidelines are addressed in Section 5.

1.5.1.2 The USIGS Standards Technology Forecast

Emerging Technical Reference Model(s)

Emerging TRMs are models that are of interest to the IGC and are candidates for incorporation in, or may influence, the future evolution of the current TRM. Emerging TRMs may already be well established or may be in development.

Emerging TRMs are not addressed in this revision of the UTA but may be added in future revisions.

Emerging Standards

Emerging standards are standards that are candidates for possible addition to the UTA mandate. The purpose of listing these candidates is to help the program manager determine those areas that are likely to change in the near term and suggest those areas in which "upgradability" should be a concern. The expectation is that emerging standards will be elevated to mandatory status when implementations of the standards mature. Emerging standards may be implemented, but shall not be used in lieu of a mandated standard.

Emerging standards are addressed in Sections 3 and 4.

Emerging Technologies

Emerging technologies are technologies expected to result in new standards that will have a significant affect on the IGC and USIGS. Emerging technologies are addressed in Section 6.

1.5.2 Structure

The UTA is organized into six sections, six appendices, and one addendum. The organization, summarized in Table 1-2, differs somewhat from the above product list organization. Specifically, the time phasing (mandated versus emerging standards) is incorporated within each architecture service area in Sections 3 and 4. The rationale is that this organization provides users involved in system planning and acquisition a clearer picture of how each set of standards is evolving.

The distinction between Sections 3 and 4 is as follows: Section 3 addresses application platform standards, and is therefore focused on exceptions and additions to the JTA platform standards. Section 4 addresses application software standards and specifications, which are not generally addressed in the JTA. Therefore, Section 4 relies on non-JTA sources, primarily the OMG and the OGC. Taken together, Sections 3 and 4 provide a collective profile of the JTA. The complete mandated profile, including applicable JTA standards, is presented in the Addendum.

Table 1-2. UTA Document Structure

Section	Element	Description
Section 1	Introduction	Purpose, Scope, Applicability, Context, USIGS considerations in using the UTA
Section 2	Technical Reference Model	A framework by which USIGS services are organized and standards are applied; represents a DoD TRM extension in which distributed object computing and open MCG&I services are emphasized
Section 3	Application Platform Entity Standards	A set of mandated and emerging standards profiling the JTA, used to collectively standardize USIGS application platform interfaces and services
Section 4	Application Software Entity Standards	Current and emerging interface specifications from OMG, OGC, and other sources, used to collectively standardize USIGS application software interfaces and services
Section 5.1	USIGS Conventions	A non-standardized but binding specification of practices within USIGS implementations. Certain conventions are needed for enforcement both internal and external to the USIGS enterprise.
Section 5.2	USIGS Guidelines	A non-binding specification of rules or accepted methods for implementing USIGS.
Section 6	Standards Technology Forecast	Technology being developed but not yet standardized, judged to be important to USIGS
Appendix A	MCG&I Domain Services	Detailed description of the MCG&I Domain Services part of the reference model
Appendix B	UTA Relationship to DII COE	Brief description of DII COE, its mandate in the JTA, and its relationship to the UTA
Appendix C	Product Specifications	List of current NIMA product specifications; part of the guidelines
Appendix D	Acronyms	Acronyms used in the UTA
Appendix E	USIGS Glossary Extract	Key terms from the USIGS Glossary used in the UTA
Appendix F	References	Document References in the UTA
Addendum (separate cover)	Standards Summary and Compliance Checklist	Complete list of USIGS Mandatory standards and specifications, including applicable JTA standards, and Checklist for determining compliance of a system with UTA standards

2. Technical Reference Model

Technical reference models (TRMs) are used to organize discussion of a technical architecture and serve to highlight the *interfaces* borne by *services in an information system*. They do not show physical components or connections, nor do they show software modules or aspects of software implementation.

In the UTA, TRM content is discussed in terms of application and service categories. Specific interfaces will not be described in this section, as they are addressed in the remainder of this document. This section will emphasize the USIGS view of components, or entities, their derivation, and their definition.

Rather than develop a TRM unique to USIGS, the USIGS extends an existing reference model, namely, the DoD TRM. The DoD TRM, as described in [JTA98], defines the current technical environment within which the USIGS must exist. This section highlights the ways in which this TRM has been extended for USIGS to address the specific needs of the Imagery & Geospatial Community (IGC). The extended reference model has two purposes. The first, more general, purpose is to provide a roadmap to guide USIGS from the legacy, procedurally-based systems of today to an object-oriented environment characterized by distributed services and standardized interfaces. The second, more specific, purpose is to organize subsequent discussion of the standards, conventions, and guidelines that are applicable to the USIGS and presented in Sections 3, 4, and 5 of the UTA.

2.1 Operational Context

Figure 2-1 shows the operational context for the UTA and the reference model. The USIGS Technical Architecture provides the means by which a functionality or process identified in the operational architecture is translated into services and APIs in the Technical Architecture.

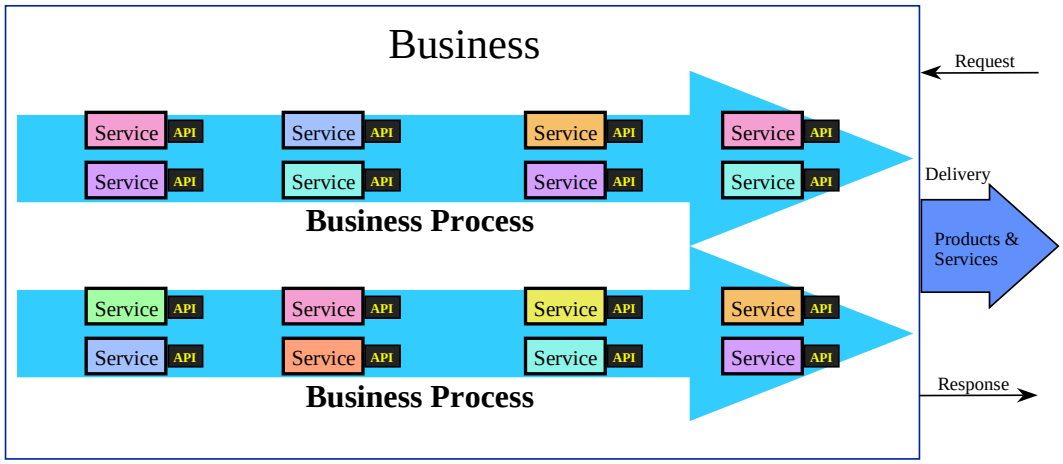


Figure 2-1. The Technical Architecture Translates Business Processes into Services and Their APIs

Further refinement of each of the business processes will identify services necessary for the brokering and trading of MCG&I information. These services can be organized based upon existing and future capabilities of the USIGS System Architecture. The services and APIs are used in the system architecture for the definition of systems and the applications that make up those systems (Figure 2-2).

In the context of USIGS, required services are used to construct applications (Mission Area Applications) analogous to the selection of tools from a toolbox. The Mission Area Applications are defined and organized to satisfy the USIGS mission. The services are derived from the functionality requirements defined in the Operational Architecture and are built or procured ONCE, then re-used as needed across the USIGS environment. Each service (COTS or GOTS) has an associated API or set of APIs which standardizes the interface to that service, thus promoting the "plug-n-play" concept envisioned for USIGS.

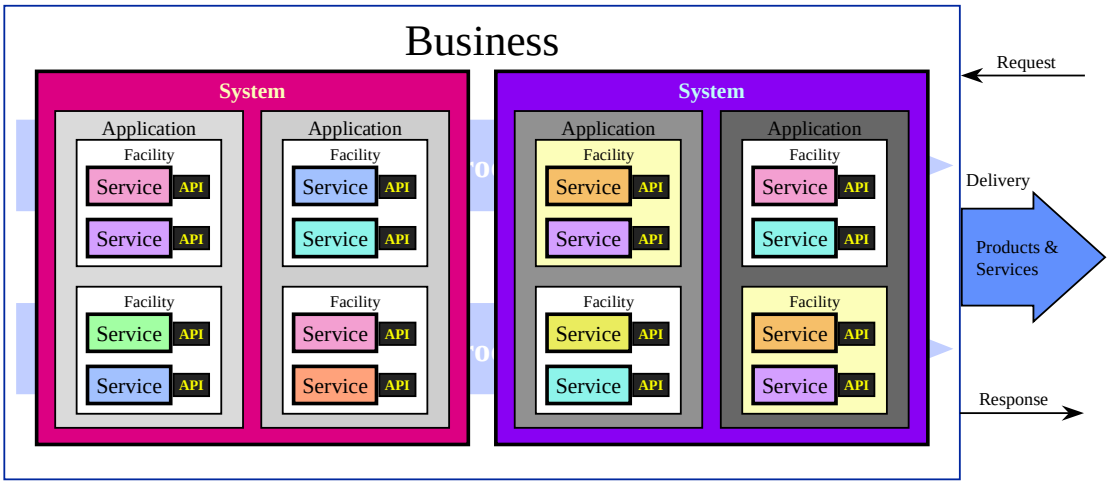


Figure 2-2. The System Architecture Uses Services and APIs Identified in the Technical Architecture in Defining Systems, Applications, and Facilities

2.2 DoD Technical Reference Model

The DoD Technical Reference Model (TRM) is defined in the TAFIM Version 3.0 [TAFIM96]. Version 2.0 of the JTA uses this TRM to establish a framework for its discussion of information technology (IT) standards. The DoD TRM defines 1) an Application Software Entity that includes both Mission Area and Common Support Applications; 2) an Application Platform Entity that contains the system support services and operating system services; 3) an External Environment; and 4) common interfaces for invoking these services and applications. The seven major service areas within the Application Platform Entity are: Software Engineering, User Interfaces, Data Management, Data Interchange, Graphics, Communications and Operating System Services. The DoD TRM is presented in Figure 2-3.

The JTA allows for the use of either the Distributed Computing Environment (DCE) standards or the Common Object Request Broker Architecture (CORBA) family of specifications for distributed computing services. This choice of distributed computing environments is based upon a choice between procedural computing or object-oriented computing. NIMA has determined that the preferable paradigm for future USIGS application interoperability is an object-oriented paradigm based on the CORBA specification. The "to-be" USIGS System Architecture is based upon the distributed object computing model. This is consistent with industry and technology trends toward modularized, component architectures. CORBA, which includes the object request broker (ORB) and a set of object services (CORBAservices), is the core of Object Management Group's (OMG's) Object Management

Architecture (OMA). The OMA also includes additional services or common facilities called CORBAfacilities [CORBA97b] that belong in the Application Software Entity part of the TRM.

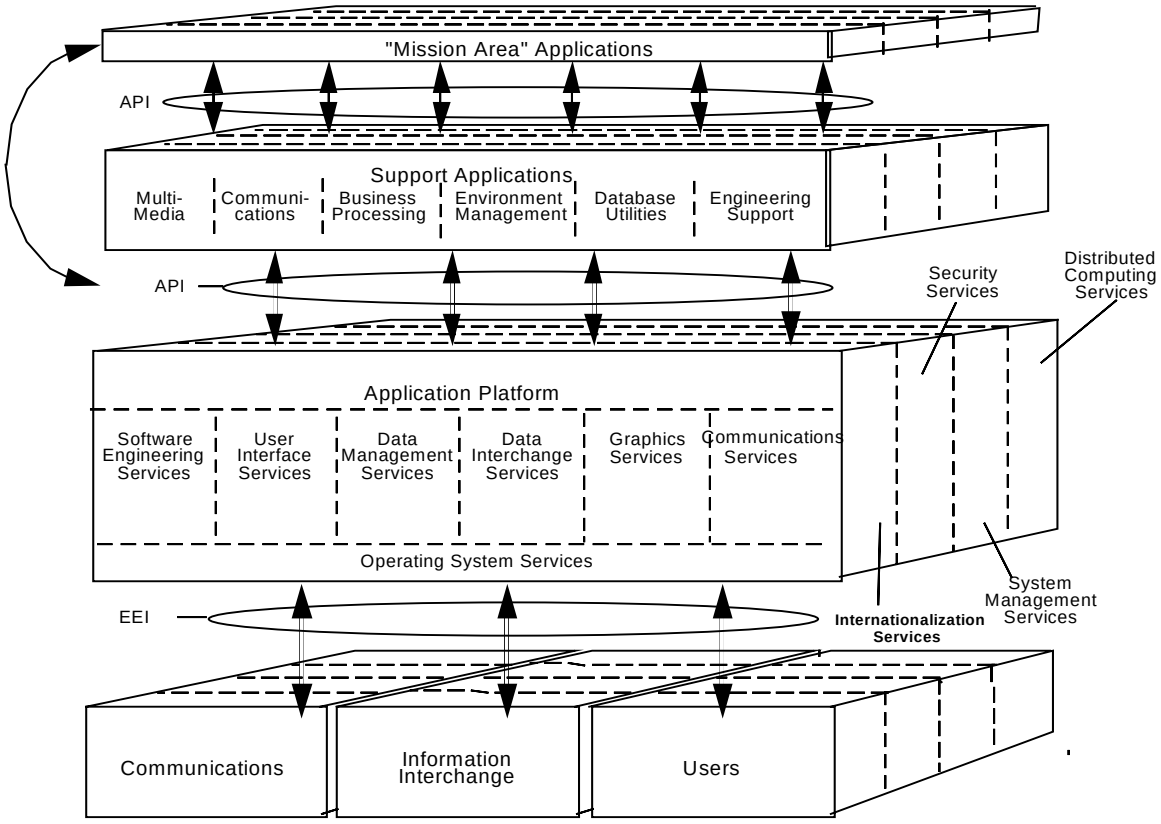


Figure 2-3. DoD Technical Reference Model

The unique functionality needs of the IGC are expressed in terms of USIGS Mission Area Application (MAA) categories and [geospatial] domain objects, collectively referred to as MCG&I services. In addition to the MAAs and domain objects, USIGS will make use of common facilities and object services to enable a distributed, object-oriented computing environment.

Based on the foregoing discussion, Figure 2-4 shows an extension to the DoD TRM that highlights the addition of USIGS MAA categories, domain objects (MCG&I services), and common facilities (CORBAfacilities) to the Application Software Entity. The object services (CORBAservices) are part of the Distributed Computing Services in the Application Platform Entity. Domain objects and common facilities, while actually common “components” (applets, plug-ins, beans, etc.) rather than traditional “applications”, are shown in the Support Applications category. Note that MAAs, domain objects, and common facilities are completely independent of the underlying platform.

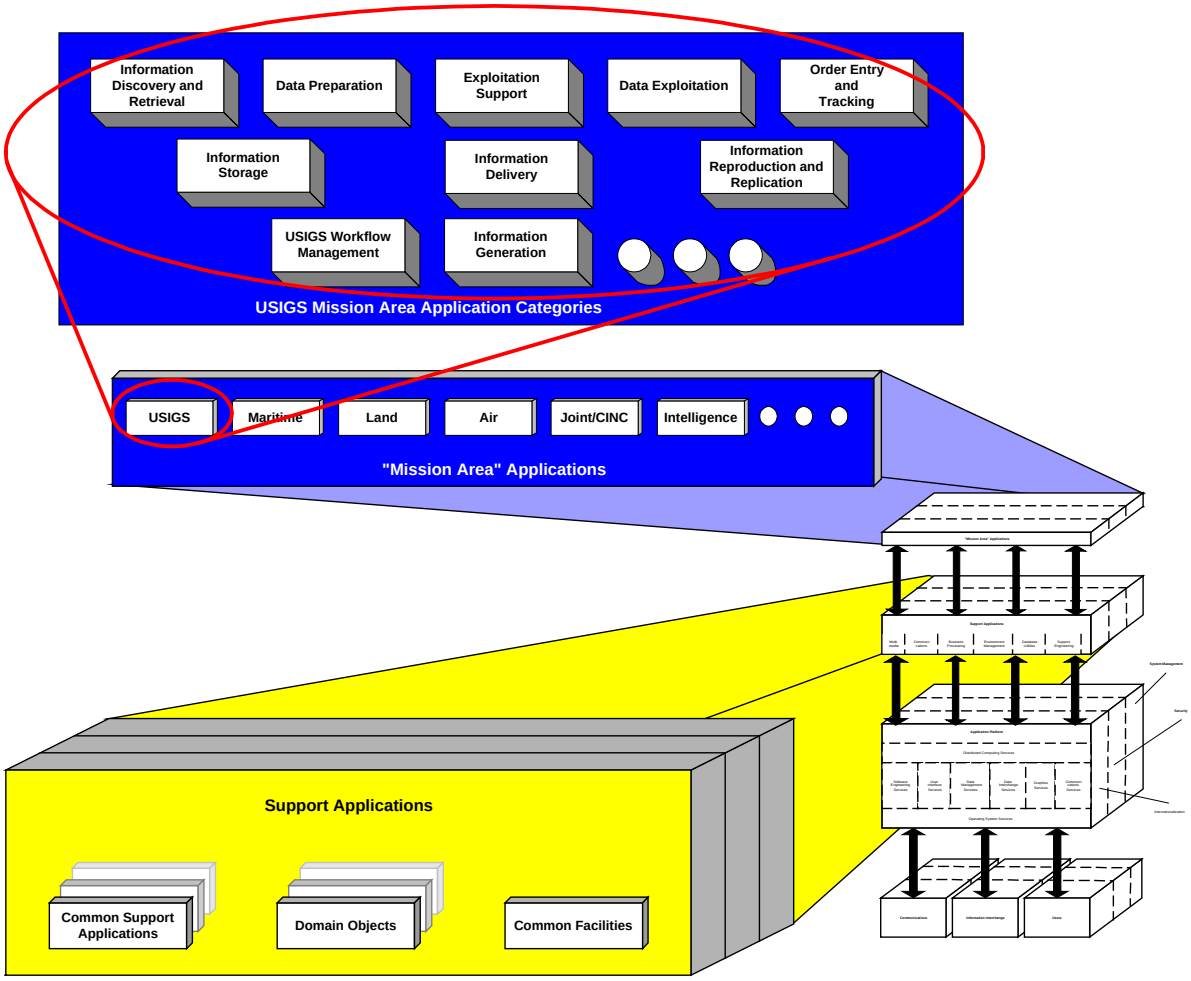


Figure 2-4. The DoD TRM Extended for USIGS

Each service area of the extended reference model will now be discussed in turn.

2.2.1 Mission Area Applications

Each USIGS MAA category is a normalized set of applications, and the categories collectively represent, at a high level, the functionality required to achieve the USIGS mission. The MAA categories are not applications themselves, but represent broad *functional areas* that in turn may comprise one or several mission applications. Mission applications are, typically, custom-built computer programs or scripts with which the user interfaces, to perform specific tasks related to a specific mission. As a rule of thumb, mission applications in USIGS are typically client-side components that invoke other components to deliver the required services. This entity type is based upon the Defense Information Infrastructure (DII) Common Operating Environment (COE) view, wherein an application is considered to be mission specific if it:

- Is used to support a specific military mission (e.g., maritime, land, Joint/CINC/Coalition, air, intelligence), or
- Provides user services for "vertical markets" within the DoD (e.g., MCG&I information production)

The USIGS MAA categories were determined through careful examination of the *NIMA Business Plan* and co-referenced with the *USIGS Operational Architecture*. Each element of the NIMA Business Plan Model represents a combination of functionality that can be represented by one or more MAA categories. The categories are not limited to those defined below, but can evolve/mature over time as the "to-be" System Architecture takes shape.

NIMA has currently identified ten MAA categories, as shown in Figure 2-4. Table 2-1 provides a brief description of each category and identifies the applicable USIGS element for each category.

Non-mission-specific applications that deliver services that are of general use (e.g., word processing, spreadsheets, etc.) are another category in the application part of the extended reference model. These applications are also described as "cross-domain" because they provide general support across multiple mission areas. These types of applications relate to the DII COE concept of Common Support Applications (see Appendix B).

Table 2-1. MAA Category Descriptions

USIGS Element	MAA Category	Description
Management	Order Entry & Tracking	Applications to accept, process, track, and support delivery of information, products, and services
Management	USIGS Workflow Management	Applications that manage information production processes
Archive & Dissemination	Information Storage	Applications that provide for digital storage and retrieval of formatted products and seamless data
Archive & Dissemination	Information Delivery	Applications that accept, store, and execute information interest profiles to deliver required information
Archive & Dissemination	Information Discovery & Retrieval	Applications to navigate the USIGS to locate and retrieve information, products, and services
Archive & Dissemination	Information Reproduction & Replication	Applications that generate, reproduce, and replicate digital products
Exploitation & Production	Data Preparation	Applications that: – Open, view, and enhance MCG&I products and information – Assemble, evaluate, validate, and augment geospatial source material
Exploitation & Production	Data Exploitation	Applications that search, integrate, extract, analyze, and prepare multiple types of geospatial information

USIGS Element	MAA Category	Description
Exploitation & Production	Information Generation	Applications that: – Generate MCG&I information, services, and products – Perform information quality control
Exploitation & Production	Exploitation Support	Applications that: – Display/manipulate geospatial information – Control tasking and data flow – Collect/report status

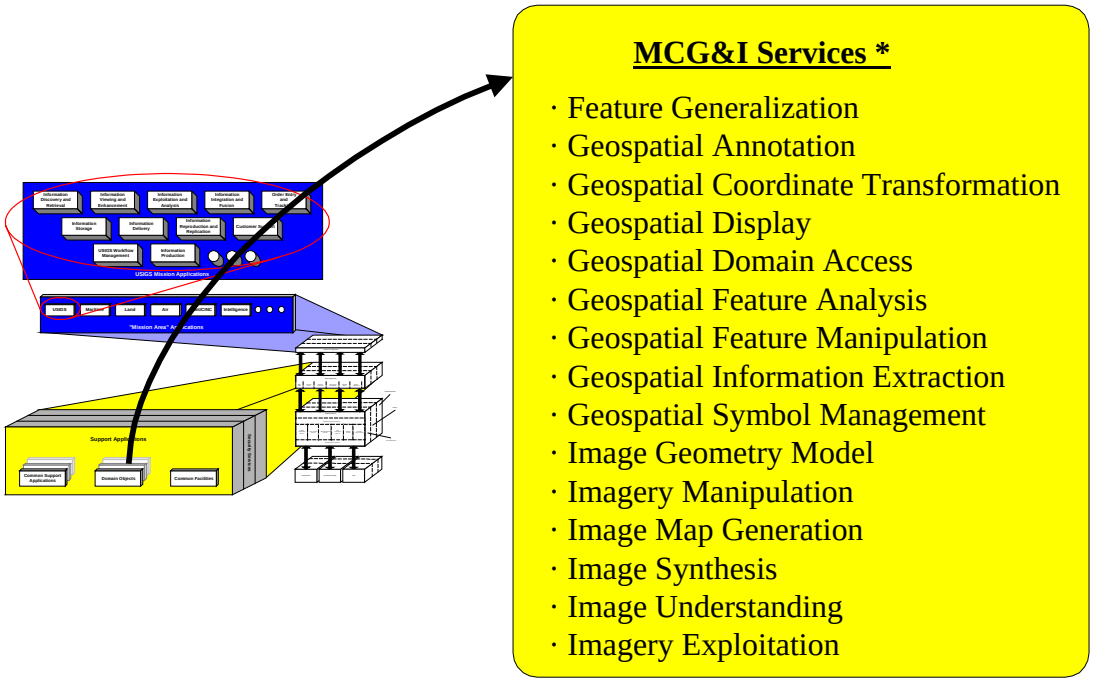
2.2.2 Domain Objects

Some applications deliver services that are specific to an information domain (such as the MCG&I domain, logistics, telecommunications, etc.), yet are invokable by applications in multiple information domains. In the context of the extended reference model, these domain services are provided via "Domain Objects," which are software components that provide a necessary service (see Section 4.2.3).

These software components or business objects will vary according to the specific domain being served. Within the DoD, the USIGS represents the MCG&I domain, and the USIGS Domain Objects are components that provide services that are specific to the MCG&I domain.

NIMA has defined a number of MCG&I services that are required to support the MCG&I domain. The USIGS adaptations include a set of MCG&I service *categories* (Figure 2-5) into which the Geospatial Domain Services themselves are collected for ease of reference and discussion. Detailed definitions of the MCG&I services are provided in Appendix A.

In a component-based architecture, such as the USIGS, these business objects are based upon standardized interfaces and provide services that can be invoked in common by applications in multiple information domains. As USIGS moves toward a true object-oriented environment, the objects providing domain services will be more appropriately described as "components" ("beans," applets, plug-ins, etc.) rather than "applications." These components will be invoked by other components that reside on USIGS clients.



* Based on OGC's OpenGIS Services Architecture

Figure 2-5. USIGS MCG&I Domain Services

The MCG&I services are described in Table 2-2.

Table 2-2. MCG&I Service Descriptions

MCG&I Service	DESCRIPTION
Feature Generalization Services	Services that modify the characteristics of a feature collection to increase the effectiveness of communication by counteracting the undesirable effects of data reduction
Geospatial Annotation Services	Services to add ancillary information to an image or a feature in a Feature Collection (e.g., by way of a label, a hot link, or an entry of a property for a feature into a database) that augments or provides a more complete description
Geospatial Coordinate Transformation Services	Services for converting geospatial coordinates from one reference system to another
Geospatial Display Services	Services that prepare and render one or more Feature Collections or Coverages to an output device. The output device may be a (temporary) electronic display or (permanent) hardcopy printer (e.g., printing a map or chart)
Geospatial Domain Access Services	A set of interfaces for locating, retrieving and disseminating selected geospatial products from a geographic information system (GIS) and for updating the contents of a GIS (by storing, deleting, or modifying geospatial products)

MCG&I Service	DESCRIPTION
Geospatial Feature Analysis Services	Services that exploit information available in a Feature or Feature Collection to derive application-oriented quantitative results that are not available from the raw data itself
Geospatial Information Extraction Services	Services supporting the domain functional areas of imagery exploitation, mensuration and geo-positioning, and tactical terrain analysis
Geospatial Symbol Management Services	Services for management of symbol libraries
Imagery Exploitation Services	Services that support the photogrammetric analysis of remotely sensed and scanned imagery, and the generation of reports with respect to the results of the analysis
Image Geometry Model Services	Support using mathematical models of image geometries, that relate image positions to corresponding real-world (e.g., ground) positions
Imagery Manipulation Services	Services for manipulating images (resizing, changing color and contrast values, applying various filters, manipulating image resolution, etc.) and for conducting mathematical analyses of image characteristics (computing image histograms, convolutions, etc.)
Image Map Generation Services	Services for manipulating and combining images for use as image maps and other uses
Image Synthesis Services	Services for creating or transforming images using computer-based spatial models, perspective transformations, and manipulations of image characteristics to improve visibility, sharpen resolution, and/or reduce the effects of cloud cover or haze
Image Understanding Services	Services that provide automated image change detection, registered image differencing, significance-of-difference analysis and display, and area-based and model-based differencing

This list of MCG&I services is consistent with and based upon the Open GIS Services Architecture being developed by the Open GIS Consortium, Inc. (OGC). It represents a suggested taxonomy of functionality relevant to the broad MCG&I domain to include government and commercial industry alike. This government/industry synergy is being maintained in order to promote the commercialization of both products and APIs necessary to support the USIGS. This is consistent with the DoD emphasis on the use of Commercial Off-the-Shelf (COTS) products and open, interoperable systems. To the maximum extent possible, COTS products and open, non-proprietary interface specifications will be used to support the needs of the USIGS. Where unique functionality is required that is not supported by current vendor offerings, this functionality will be provided by Government Off-the-Shelf (GOTS) applications (MINT and RULER, e.g.). Common interfaces (such as the current GIAS and GIXS) will be developed to support access to these GOTS services from anywhere across the distributed USIGS environment. NIMA will strive to support formal standardization processes for these interfaces through established standards bodies and the commercialization of such interfaces through consortia such as the OMG and the OGC. Note that some of the defined “services” such as annotation or display may stay tied to the client-side application and not be “broken-out’ as individual, distributed services.

MCG&I services may be of two levels of applicability (Figure 2-6): producer-unique and general. Certain of the USIGS applications will apply only to producers. Correspondingly, certain MCG&I services will provide capability that will be shared among producer applications, but will have no applicability elsewhere (for example, certain intelligence oriented services). There will be a second level of MCG&I services that are generally available across the USIGS information domain and with applications in other information domains that require some MCG&I services. From the viewpoint of USIGS, there will also be business objects made available (to USIGS applications) from other information domains and general business objects that are non-domain specific.

Table 4-2 lists services from other domains (such as Healthcare and Finance) that are judged to be of use across USIGS.

2.2.3 Common Facilities

Common Facilities are components that are invoked by application programs in order to provide a specific service or set of services that are of general utility. In the USIGS extended reference model, common facilities are taken from the OMG OMA, because they are built on CORBA. Figure 2-7 lists those facilities currently identified by OMG. As the Interface Design Language (IDL) specification for each facility is completed and published, it will be thoroughly evaluated. Those that are found to meet the requirements for the USIGS will be adopted as USIGS components.

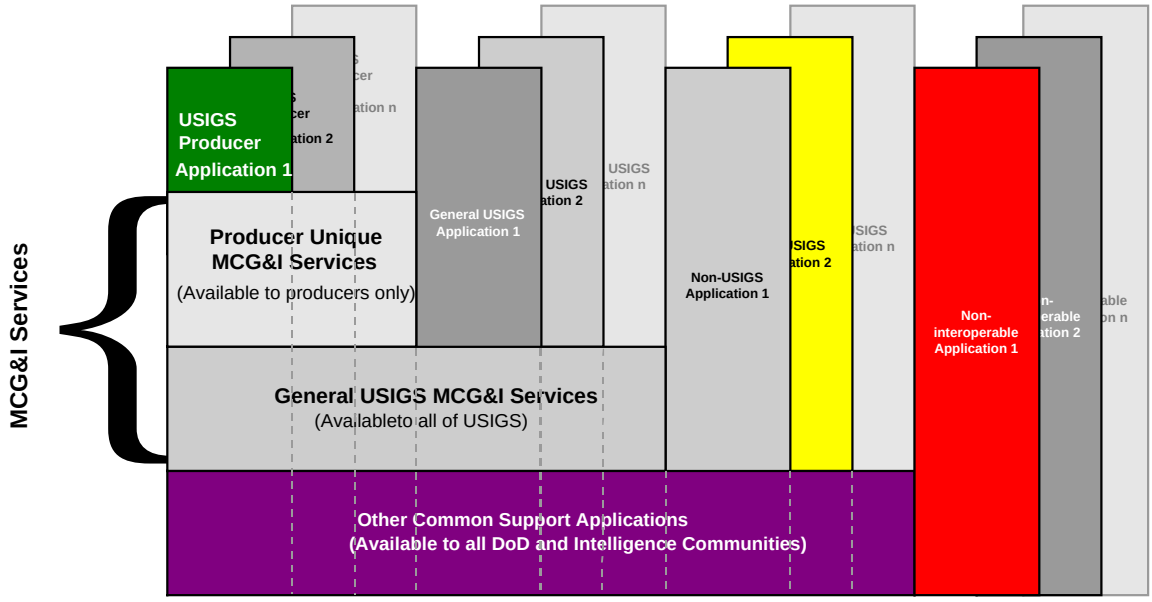


Figure 2-6. Common Support Application Applicability Layers

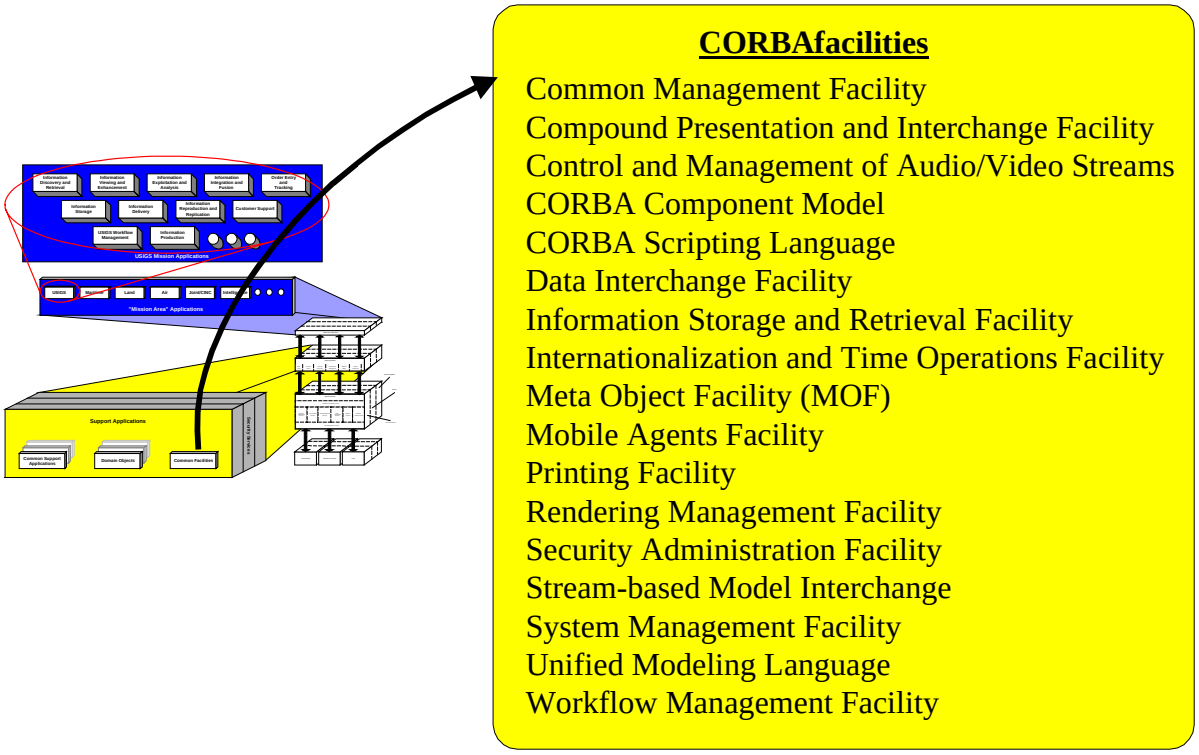


Figure 2-7. USIGS Common Facilities

A description of each CORBAfacility follows in Table 2-3.

Table 2-3. CORBAfacility Descriptions

CORBAfacility	Description
Common Management Facility	Provides a set of utility interfaces for system administration functions. These abstract basic functions such as control, monitoring, security management, configuration, and policies that are needed to perform systems management operations, such as adding new users, setting permissions, installing software, and so forth.
Compound Presentation and Interchange Facility	Enables the creation of cooperative component software that supports compound documents, that can be customized, that can be used collaboratively, and that is available across multiple platforms. Also provides for the storage and interchange of data objects, and roughly maps to the persistent storage subsystem of a compound document architecture.
Control and Management of Audio/Video Streams	The Control and Management of Audio/Video Streams specification addresses these issues: topologies for streams, multiple flows, stream description and typing, stream interface identification and reference, stream set-up and release, stream modification, stream termination, multiple protocols, quality of service, flow synchronization, interoperability, and security.
CORBA Component Model	This distributed component model will be based upon the OMA, and will be capable of inter-operating with other emerging component technologies, particularly the JavaBeans component model.

CORBAfacility	Description
CORBA Scripting Language	Defines conventions and interfaces that allow access to the key functionality of an object from another object. The design goal of this facility is to support user visible objects that are larger grained than the typical ORB object. The typical object acted upon by this facility would be a document, a paragraph, a spreadsheet cell, and so forth. The emphasis of the facility is for objects to expose enough of their capabilities so they may be driven by scripts and macros.
Data Interchange Facility	Allows for the exchange of information across networks of heterogeneous computer systems by providing a common information model and a common way of encoding information within that model. Encoding must support not only character data, but other sorts of data as well, including imagery, graphics, multimedia documents, and electronic mail. Enables objects to interoperate through exchange of data, and can be used for many forms and kinds of data transfer, such as: bulk transfer; interchange of formatted data such as TIFF, GIF, EPS, NITF, etc.; structured data transfer such as ISO IDL specified data types; interchange of domain-specific object representations; and the data interchange between objects and encapsulated software (legacy applications).
Information Storage and Retrieval Facility	Comprises the higher level storage and retrieval specifications for distributed applications. These specifications will be applicable to a wide range of information services, including data base access and information highways.
Internationalization and Time Operations Facility	Enables developers to use an information system or application in their own language using their own cultural conventions. In addition, this technology will allow the developer to use a culture's numeric and currency conventions, and keep track of time zones.
Meta Object Facility	Defines the interfaces and sequencing semantics needed to create, store and manipulate object schemas that define the structure, meaning, and behavior of other objects within the OMG Object Management Architecture. These objects may be application objects, common business objects, objects representing analysis and design models of applications, or objects providing the functionality of Common Facilities and Common Services. The Meta Object Facility can be used in an information system (such as a repository) that enables an enterprise to specify and manage a wide variety of information assets with a common, integrated set of services. The use of a common Meta object facility for specifying the schemas of the information assets will play a key role in helping to achieve data and process integration by enabling tools and processes to share information and coordinate activities.
Mobile Agents Facility	Supports the need to create massively distributed information systems over Wide Area Networks. Agent technology efforts range from building these massively distributed systems to mobile information systems, intelligent workflow systems, and agile corporation information structures.

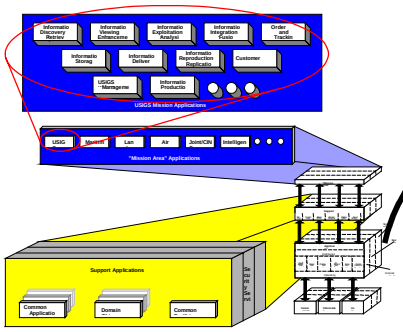
CORBAfacility	Description
Printing Facility	One component of a coordinated set of facilities and standards needed to satisfy the printing requirements of the modern distributed office. Together, the capabilities provided must enable users to create and produce high-quality documents in a consistent and unambiguous manner within a distributed object environment. The Printing Facility should be able to meet a range of printing requirements from simple one document, one copy printing, all the way up to high volume production printing, which might involve several documents, several copies, several printers.
Rendering Management Facility	Provides facilities to present information for output on devices such as screens, printers, plotters and sound and speech output devices. It also handles user input from a variety of hardware devices such as a mouse, keyboard, scanner, speech recognition device, digital camera, and security devices. Rendering management includes support for window management, class libraries for user interface objects, user interface dialog objects, and abstractions of the many different input/output devices.
Security Administration Facility	Provides standard interfaces, as well as the necessary control mechanisms, to facilitate required security protections, including provisions for: - User registration, password maintenance, permissions maintenance - Access control, authentication, and audit trail maintenance - Resource registration - Security classification downgrading - Encryption key management - Discretionary and mandatory access control.
Stream-based Model Interchange	A stream-based model interchange format (SMIF) that includes a transfer format specification for file export/import of models, and a transfer format specification for unique identification of the version of the MOF meta-metamodel and any metamodels referenced but not included in an SMIF-compliant transfer.
System Management Facility	A profile of the Open Group's Systems Management Reference Model; consists of three basic components: Managers, which implement Management Tasks and other composite management functions; Managed Objects, which encapsulate resources; and Services, which provide the X/Open System Management (XSM) Support Environment.
Unified Modeling Language	A comprehensive modeling language whose semantics include these elements: Model management; Foundation (core, extension mechanisms, auxiliary elements, and data types); and Behavioral elements (use cases, state machines, collaborations, and common behavior). The specifications are packaged so that subsets of the Unified Modeling Language (UML) and facility can be implemented without breaking the integrity of the language.

CORBAfacility	Description
Workflow Management Facility	Provides management and coordination of objects that are part of a work process (for example, purchase orders). This facility will provide support for production-based workflow in the form of structured, pre-defined processes that are governed by policies and procedures, as well as ad-hoc, or coordination-based workflows, including evolving workflows defined by one or more people to support the coordination of knowledge workers.

2.2.4 Distributed Object Computing Services and Other Platform Services

Distributed Object Computing Services are capabilities that permit procedures and objects to be invoked on remote hosts as though they were local to the calling module. In addition to these basic capabilities, the distributed computing component is accompanied by a variety of enabling services, such as security, time, persistence, and naming; many of these services are required for the development of applications that are distributed. The choice of CORBA responds to the need for object services; APIs for such services have been defined by the OMG in its CORBAservices specification [CORBA97c]. In a CORBA environment the integral object request broker (ORB) acts as an intermediary between invoking and invoked objects. In essence, the ORB acts as a software backplane. Mission Applications invoke Common Support Applications, Common Facilities, and Object Services via the ORB. Common Support Applications and Common Facilities can invoke other Common Support Applications and Common Facilities, as well as Object Services, via the ORB. Figure 2-8 and Table 2-4 present not only the services identified in the CORBAservices specification, but also CORBA enhancements that have been identified as separate items to be specified.

In addition to the categories discussed above, the DoD TRM addresses a number of other Platform Services. Platform Services in the DoD TRM include the operating system and primitive-level services that provide fundamental functionality to the platform in general. While Platform Services are of great significance in the development of software using traditional structured procedural techniques, as the USIGS migrates to a fully component based architecture based on CORBA, the specifics of the Platform Services will take on less and less importance. When the USIGS is completely migrated to a component based architecture based on CORBA, the choice of platform and services will depend only on performance characteristics and the meeting of minimal standards for network services.



CORBAservices and Enhancements

Concurrency Control Service
DCE/CORBA Interworking *
Event Service
Externalization Service
Fault Tolerance *
Firewall *
IDL to Java *
Interoperable Name Service
Java to IDL *
Licensing Service
Life Cycle Service
Messaging Service
Multiple Interfaces and Composition *
Naming Service
Object Collections Service
Objects-by-Value *
Persistent State Service
Property Service
Query Service
Relationship Service
Security Service
Tagged Data *
Time Service
Trading Object Service
Transaction Service

* CORBA enhancements

Figure 2-8. CORBAservices and Enhancements Supporting USIGS

Table 2-4. CORBAservice and Enhancement Descriptions

CORBAservice	Description
Concurrency Control Service	Enables multiple clients to coordinate their access to shared resources. Coordinating access to resources means that when multiple, concurrent clients access a single resource, any conflicting actions by the clients are reconciled so that the resource remains in a consistent state. The Concurrency Control Service consists of multiple interfaces that support both transactional and non-transactional modes of operation.
DCE/CORBA Interworking	Specifies application level interworking, including CORBA clients interacting with DCE servers; DCE clients interacting with CORBA servers; and provisioning CORBAservices and CORBAfacilities (e.g. security, naming, time) with existing DCE components (e.g. security services, directory services, distributed time facility).
Event Service	Provides basic capabilities that can be configured together in a very flexible and powerful manner. Asynchronous events (decoupled event suppliers and consumers), event “fan-in,” notification “fan-out,” and -- through appropriate event channel implementations -- reliable event delivery are supported. Both push and pull event models are supported; i.e., consumers can either request events or be notified of events, whichever is needed to satisfy application requirements.
Externalization Service	Defines protocols and conventions for the externalization and internalization of objects. Externalizing an object is to record the object state in a stream of data (in memory, on a disk file, across a network, etc.) and then internalize it into a new object in the same or different process. The externalized object can exist for arbitrary amounts of time, be transported by means outside the ORB, and be internalized in a different, disconnected ORB.
Fault Tolerance	Addresses the need for standard CORBA functionality to support fault tolerant applications, such that the clients of these applications will be largely insulated from such details as management of redundant copies, failure masking, and recovery.
Firewall	Specifies use of IIOP in network firewalls for the purpose of controlling limited use from the internet or intranet of an organization's CORBA-based applications, and optionally similar specification with respect to any other inter-ORB protocols.
IDL to Java	Technology that provides a Java language mapping for the OMG IDL specification language; the Java Mapping specification will provide the ability to access and implement CORBA objects within programs written in the Java language.
Interoperable Name Service	A way to configure, at startup/runtime, independently-developed clients to use a common, initial naming context, a way to use "stringified" names interoperability, a better definition of identity between components, and support for URL-style "naming."

CORBAservice	Description
Java to IDL	This is an enhancement of the CORBA Java language mapping with a Java-to-IDL mapping. A Java-to-IDL mapping will allow developers to build distributed applications directly in Java and communicate via IIOP. By generating IDL from Java code many languages have access to these Java written components.
Licensing Service	Provides a mechanism for producers to control the use of their intellectual property in a manner determined by their business and customer needs. This service offers fundamental usage control.
Life Cycle Service	Defines services and conventions for creating, deleting, copying, and moving objects. Because Distributed Computing Environments support distributed objects, life cycle services define services and conventions that allow clients to perform life cycle operations on objects in different locations.
Messaging Service	Provides interfaces that allow clients to make requests on an object without blocking the client execution thread. Some requests are not expected to be complete during the lifetime of the client execution environment, so mechanisms will be established to receive the response and process it appropriately. The service allows object servers to control the order in which incoming requests are processed.
Multiple Interfaces and Composition	Deals with the resolution of conflict between multiple IDL interfaces on the same object; provides the means for objects to be composed of logically distinct services by the use of multiple interface definitions.
Naming Service *(will be superseded by Interoperable Name Service)*	Provides the ability to bind a name to an object relative to a naming context. A naming context is an object that contains a set of name bindings in which each name is unique. To resolve a name is to determine the objects associated with the name are given context. Through the use of a "names library," name manipulation is simplified and names can be made representation independent thus allowing their representation to evolve without requiring client changes.
Object Collections Service	Provides a uniform way to generically create and manipulate the most common collections. Collections are groups of objects which, as a group, support some operations and exhibit specific behaviors related to the collection, such as stacks, queues, and lists.
Objects-by-Value	Specifies interfaces that provide for the passing of CORBA objects by value (rather than by reference) as parameters in CORBA object operations.
Persistent State Service	Provides common interfaces to the mechanisms used for retaining and managing the persistent state of objects. The Persistent State Service will be used in conjunction with other Object Service Interfaces, for example, naming, relationships, transactions, life cycle, etc. The Persistent State Service has the primary responsibility for storing the persistent state of objects, with other services providing other capabilities.

CORBAservice	Description
Property Service	Provides the ability to dynamically associate named values with objects outside the static IDL type system. The interfaces provided by this service are used for defining, deleting, modifying, enumerating, and checking for the existence of properties. By using the interfaces defined by the Property Service, useful information can be associated with an object's state, for example, a title or a date.
Query Service	Provides query operations on collections of objects. The queries are predicate-based and may return collections of objects. They may be specified using object derivatives of Structured Query Language (SQL) and/or other styles of object query languages including direct manipulation query languages. Query operations include selection, insertion, updating, and deletion on collections of objects or data.
Relationship Service	Allows entities and relationships to be explicitly represented. Entities are represented as objects. The service defines two new kinds of objects: relationships and roles. A role represents an object in a relationship. The Relationship interface can be extended to add relationship-specific attributes and operations. Similarly, the Role interface can be extended to add role-specific attributes and operations.
Security Service	Protects an information system from unauthorized attempts to access information or interfere with its operation. For example, security services may include (but are not limited to) the following: - Confidentiality: information is disclosed only to users authorized to access it. - Integrity: information is modified only by users who have the right to do so and only in authorized ways. It is transmitted only between intended users and in intended ways. - Accountability: users are accountable for their security relevant actions. A particular case of this is non-repudiation where responsibility for an action cannot be denied. - Availability: Use of the system cannot be maliciously denied to authorized users.
Tagged Data	A general-purpose capability that can handle arbitrary items of data of in-memory size, where each data value is tagged for identification; includes interfaces and/or mechanisms that will provide a standard way of creating, accessing, updating, and manipulating such arbitrary data structures or objects.
Time Service	Maintains current time, ascertains order in which events occurred, and computes the interval between two events.
Trading Object Service	Provides a matchmaking service for objects – registers availability of the service, provides parameters, distinguishing attributes, and names of operations to which it will respond. It also allows objects in different domains to negotiate and share services without losing control of their own policies and services.

CORBAservice	Description
Transaction Service	Supports multiple models (flat and nested) of transactional behavior in a distributed heterogeneous environment. The Transaction Service brings the transaction paradigm, essential to developing reliable distributed applications, and the object paradigm, key to the productivity and quality in application development, together to address the business problems of commercial transaction processing.

The DoD TRM Platform Services are listed and described in Table 2-5.

Table 2-5. DoD Platform Service Descriptions

Platform Service Name	Description
Data Interchange	Includes file formats and protocols required for the transfer of information among applications program.
Data Management	Includes File Access, File Management, Database Access, and Database Management. Includes definition, storage, and retrieval of files, databases, and object bases distributed over the network. Includes data exchange facilities between users, computers, and databases.
Graphics	Services that provide for device-independent rendering of both vector and raster based graphics, for purposes including, but not limited to: plotting, computer aided design manipulation and display, simulation, animation, scientific visualization, process control, and art. These services include graphical, attribute and input primitives; coordinate and systems clipping; and input and output model implementation.
Network	An infrastructure of coordinated services primarily supporting connectivity and data exchange between one mission application system or workstation and another. Network services provide the capability to send, receive, forward, and manage electronic and voice messages. They also provide real-time information exchange services in support of interpersonal conferences. These services include Personal Message Transfer, Organizational Message Transfer, enhanced telephony, shared screen, teleconferencing, and broadcast.
Operating System	The core services required for the management and control of the hardware platform resources, including the processor (CPU), memory, physical file storage and retrieval, and generalized input and output. Services in this category include such platform management functions as: process, physical file, input/output, and memory management.
Security Systems Management	Administrative tools required for the management of information and communications security within a single platform and between and among multiple platforms.
Software Engineering	A collection of the basic services required to develop software for a given platform, including text editors, compilers, linkers, interpreters, and certain virtual machines (e.g., the Java virtual machine). System Management. Ability to manage all hardware and software resources in a heterogeneous, distributed information system. Includes network administration, and system administration. Includes four of the five System Management Functional Areas defined by the International Organization for Standardization (ISO): configuration management, fault management, performance management, and accounting management. Three levels of management have been defined for DII: global, campus, and site.

Platform Service Name	Description
System Management.	Services required to effectively manage a wide variety of diverse resources (such as printers, software, users, processors) to achieve the goals of an open system environment. While the individual resources may differ widely, the abstraction of these resources as managed objects allows for treatment in a uniform manner. Service categories include state management, configuration control, performance monitoring, fault monitoring, user/group management, and usage monitoring.
Transaction Processing	Services required to support transactional access to a single database manager on a single platform or on multiple platforms (i.e., a distributed database management system), transactional access to non-database resource managers (e.g., automated tellers), On-Line Transaction Processing (OLTP), and distributed transaction processing.
User Interface	Services required for the exchange of information with a user. Specifically, services to display information, including rendered graphics, on a user's workstation, printer, or other display device and to accept information from a user through an input device.

The DoD TRM also defines "External Entities." External Entities are defined in the *IEEE Draft Guide to the POSIX Open System Environment* (IEEE P1003.0) and are of two types: Information Interchange Entities and Communications Entities. Information Interchange Entities are those hardware devices with which the platform services exchange information. These include information storage devices such as disk drives, tape drives, etc., and devices through which a user communicates with a system, such as keyboards, display devices, and mice. Communications entities are those hardware devices required to exchange information among platforms, basically the wires, switches, etc.

2.3 Summary of Reference Model Categories and Components

Table 2-6 identifies components in each of the extended reference model service categories. Mission Applications, Common Support Applications, Distributed Computing Services, and other Application Platform Services are identified. Each service category includes several services or components.

Table 2-6. Extended Reference Model Categories and Components

Service Category	Source	Components	
Application Software Entity (Profiled in Section 4)			
Mission Area Application Categories (USIGS)	--	Information Discovery & Retrieval Data Preparation Data Exploitation Information Generation USIGS Workflow Management Information Reproduction & Replication	Order Entry & Tracking Exploitation Support Information Delivery Information Storage
Support Applications (MCG&I domain objects)	OGC/Ref. Model	Geospatial Domain Access Geospatial Feature Manipulation Geospatial Information Extraction Geospatial Coordinate Transformation Geospatial Symbol Management Image Map Generation Image Understanding Facility Geospatial Feature Analysis	Geospatial Annotation Imagery Manipulation Feature Generalization Imagery Exploitation Geospatial Display Image Geometry Model Image Synthesis
Support Applications (CORBAfacilities)	OMG/CORBA	Common Management Compound Presentation and Interchange Control and Management of A/V Streams CORBA Component Model CORBA Scripting Language Data Interchange Information Storage and Retrieval Internationalization and Time Operations Stream-based Model Interchange	Meta Object Mobile Agents Printing Facility Rendering Management Security Administration System Management Unified Modeling Lang. Workflow Management
Application Platform Entity (Profiled in Section 3)			
Distributed Computing Services	OMG/CORBA	Concurrency Control DCE/CORBA Interworking Event Externalization Fault Tolerance Firewall IDL to Java Interoperable Name Java to IDL Licensing Life Cycle Messaging Multiple Interfaces and Composition	Naming Object Collections Objects-by-Value Persistent State Property Query Relationship Security Tagged Data Time Trading Object Transaction
Other Platform Services	JTA	Data Interchange Data Management System Management Services Security Systems Management Software Engineering	Graphics Network Operating System Transaction Processing User Interface

This Page Intentionally Left Blank

3. Application Platform Entity Standards

3.1 Background

This section specifies the Imagery and Geospatial Community (IGC) profile of the DoD Joint Technical Architecture (JTA) for Application Platform Services. The profile, in addition to requiring the use of most JTA standards, also mandates standards which are in addition to or take exception to those currently mandated in the JTA 2.0. Differences between the JTA and UTA standards are clearly noted. This section also includes additional information on other standards of special interest to the IGC which may affect planned acquisitions. Each referenced standard includes textual descriptions and usage criteria.

The IGC Profile is organized in a format consistent with that of the JTA. The JTA addresses commercial and Government standards common to most DoD information technology, grouped into categories: Information Processing Standards; Information Transfer Standards; Information Modeling, Metadata, and Information Exchange Standards; Human-Computer Interface Standards; and Information Systems Security Standards.

Some of the significant standards changes from the previous (first) version of the UTA:

- New mandate for MIL-STD-2500B (NITFS 2.1); which supersedes MIL-STD-2500A (NITFS 2.0)
- New mandate for MIL-STD-2301A, CGM for NITFS; which supersedes MIL-STD-2301
- New mandate for CORBA 2.2; superseding version 2.1
- Mandate for new version of the DoD/IC/USIGS Video Imagery Standards Profile (VISP) version 1.3; superseding earlier version 1.1
- Addition of NITFS Support Data Extensions for specific NITF implementation categories

Note: Proper understanding of the UTA profile of the JTA (this section) requires the use of both the UTA and JTA 2.0 documents. The JTA 2.0 is available at: www-jta.itsi.disa.mil or from the NIMA Systems Engineering & Integration Division (SOS), Engineering Branch (SOSE).

3.2 Standards Definitions

The UTA describes several types or categories of standards. The definitions of these standards types and categories are consistent with those in the JTA unless noted. The definitions in this section are necessary to understand the content of this section and the usage requirements for the standards.

Standards

A ‘standard’ is a document that establishes engineering and technical requirements for processes, procedures, practices, and methods. The standards in the UTA and JTA include commercial, government, DoD standards and specifications, as well as other kinds of authoritative documents.

Profiles

‘Profile of a Standard’ - Some standards have optional parts or parameters that can affect interoperability, so an individual standard may be further defined by a separate, authoritative document called a ‘profile’ or a ‘profile of a standard’ which refines—via specified options and parameters—the implementation of the original standard.

‘Standards Profile’ - A collection of two or more standards, profiled together to meet the requirements of a specific user community. A standards profile may also include one or more instances of a ‘profile of a standard’; an example of this is the National Imagery Transmission Format Standard (NITFS) standards profile described in this section.

Exceptions and Additions

This section of the UTA is the IGC standards profile of the JTA standards. The terms used to describe differences between the UTA and JTA are ‘Exception’ and ‘Addition.’

‘Exception to JTA’ - a UTA standard which replaces, or supersedes, an existing mandated or emerging standard from the JTA 2.0. Exceptions are rare, since the JTA was developed with input from NIMA. This version of the UTA only contains seven (7) exceptions, all of which are updated versions of the JTA standard. An exception is to be used in all new or upgraded USIGS systems IN PLACE OF the JTA standard.

‘Addition to JTA’ - an additional standard required for all new or upgraded USIGS systems, exceeding the mandatory or emerging standards listed in the JTA 2.0. An addition is usually non-conflicting with the JTA mandate; any known conflicts will be noted in the discussion of the mandate. There are numerous ‘Additions to JTA’ in this version of the UTA. These standards will be proposed for inclusion in future versions of the JTA.

USIGS Status

The time phasing that is part of the information provided by a technical architecture is reflected in the UTA as a ‘USIGS Status’ indicator. Terms used to describe the USIGS status of each of the standards and specifications presented in both Sections 3 and 4 are Mandatory and Emerging:

Mandatory: Mandatory standards in the UTA and the JTA must be implemented or used by USIGS systems that have a need for the corresponding service areas. A standard is mandatory only if the service or interface provided is necessary in the system under development. The standards in the UTA are grouped into service areas such as ‘Still Imagery Data Interchange’ or ‘Distributed Object Computing.’ If the service area is to be implemented in a USIGS system, it must be done using the UTA (or JTA) mandated standard(s) *at a minimum*. The UTA and JTA do not prohibit the use of additional standards in a service or interface above and beyond this minimum, mandatory set; however, these other standards

must not conflict with the UTA and JTA mandates. All new systems within USIGS must support the minimum set of mandatory standards within the UTA. Migration systems will be evaluated on a case-by-case basis as described in Section 1.2.1.1. The UTA identifies standards or practices, beyond those also mandated in the JTA 2.0, which are necessary to support interoperability within the USIGS. Each mandated UTA standard is identified by a formal reference citation that is suitable for inclusion within Requests for Proposals (RFPs), Statements of Work (SOWs), or other formal acquisition documents.

All new systems within USIGS must support the mandatory standards from the JTA 2.0 unless otherwise noted in the UTA Profile by an 'Exception.' Several UTA standards are mandatory only for a specified subset of the USIGS. For each of these standards, the Remarks column of Table 3-1 and/or the Usage paragraph will specify which part of the USIGS must implement the standard.

Emerging: These are existing standards or developing standards that may become mandatory in the UTA at some future date. The UTA definition of 'Emerging' includes standards or specifications under development. This expands the JTA definition, which is normally limited to approved, formal documents. The purpose of listing these emerging standards in the UTA is to help the USIGS acquisition and development community determine those services or interfaces that are likely to undergo change in the next several years. The expectation is that many of the emerging UTA (or JTA) standards will most likely be elevated to mandatory UTA status at some time in the future. This is likely to happen when the services provided by these standards are needed within USIGS to enhance existing functions or to provide additional functionality not currently available in existing standards.

An Emerging UTA or JTA standard may also be implemented in new or upgraded USIGS systems, but not in place of a Mandatory UTA or JTA standard. The decision to require an emerging standard in new or upgraded USIGS systems should be made after considering the developmental state of the standard and the predicted development timeframe of a system.

3.3 Standards Profile Summary

Table 3-1 lists the IGC exceptions and additions to the mandated JTA standards, grouped by JTA-defined Service Areas. If a UTA Exception or Addition to the JTA is included in the table, the standard that supports that function or service is identified by name and document identifier assigned by the specification's issuing organization. If no UTA standards or profiles are listed for a specific JTA service area, the UTA mandates all the standards in the indicated JTA section *without exception*. Emerging standards exceptions and additions to the JTA are also included in this table. Internet URLs for obtaining copies of each standard and specification in the table are provided at the beginning of Section 3.4.

A complete summation of the JTA 2.0 and UTA standards, sorted by each service area, is provided in an addendum to the UTA. That set of tables is not intended to be a comprehensive substitute for the UTA or JTA documents.

This Page Intentionally Left Blank

Table 3-1. UTA Profile of Mandatory and Emerging JTA Information Technology Standards

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.2 INFORMATION PROCESSING				The UTA includes both Exceptions and Additions to the JTA 2.0 mandated standards in JTA Section 2.2. The UTA also includes additions to the JTA emerging standards.
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard (NITFS)	MIL-STD-2500B, National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 22 August 1997; with Notice 1, 2 October 1998	EXCEPTION TO JTA. NITF 2.1 supersedes the NITF 2.0 (MIL-STD-2500A). With the addition of the Notice 1, 2500B and NATO STANAG 4545 (NSIF), Edition 1, are technically equivalent.
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	Computer Graphics Metafile (CGM) Implementation Standard for the NITFS	MIL-STD-2301A, Computer Graphics Metafile (CGM) Implementation Standard for the NITFS, effective 5 June 1998	EXCEPTION TO JTA. MIL-STD-2301A is the NITFS profile of the ISO CGM standard and enhances the CGM capabilities in MIL-STD-2301, Computer Graphics Metafile (CGM) Implementation Standard for the NITFS, 18 June 1993. 2301A supersedes 2301. Use of MIL-STD-2301A is only mandatory for NITF 2.1-compliant files.
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM)	MIL-STD-188-197A 12 Oct 1994	ADDITION TO JTA. This standard is only required for ingesting and decompressing ARIDPCM compressed files (NITF 1.1 format imagery) This mandate is unchanged since UTA 1.0, 6 Nov 1997.

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	ICHIPB Support Data Extensions for the National Imagery Transmission Format	ICHIPB, 16 November 1998	ADDITION TO JTA. This standard is only applicable to a subset of the USIGS: For systems which produce, disseminate, or use National Technical Means (NTM), Tactical/Airborne imagery, or Commercial Satellite imagery ONLY
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	National Imagery Transmission Format Profile for Imagery Access Extensions (PIAE)	PIAE, Version 3.0, 25 September 1997; as documented in Section 6 of the Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF) 1.0, 25 August 1998	ADDITION TO JTA. This standard is only applicable to a subset of the USIGS: For systems which produce, disseminate, or use National Technical Means (NTM), Tactical/Airborne imagery, or Commercial Satellite imagery ONLY
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	Synthetic Aperture Radar (SAR) Support Data Extensions (SDE) for the National Imagery Transmission Format Standard	SAR SDE, 20 May 1996; as documented in Section 8 of the Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF) 1.0, 25 August 1998	ADDITION TO JTA. This standard is only applicable to a subset of the USIGS: For systems which produce, disseminate, or use Tactical/Airborne imagery ONLY
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	Visible, Infrared, and Multispectral Airborne Sensor Support Data Extensions (SDE) for the National Imagery Transmission Format Standard	VIMAS SDE, 25 September 1997; as documented in Section 10 of the Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF) 1.0, 25 August 1998	ADDITION TO JTA. This standard is only applicable to a subset of the USIGS: For systems which produce, disseminate, or use Tactical/Airborne imagery ONLY

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.2.2.2.1.4.4 Still Imagery Data Interchange	Mandatory	HISTOA Extension, Softcopy History Tag	HISTOA Extension, as documented in Section 15 of The Compendium of Controlled Extensions (CE) for the National Imagery Format Transmission Format (NITF), Version 1.0, 25 August 1998	ADDITION TO JTA. For systems which produce, disseminate, or use National Technical Means (NTM)
2.2.3.3.5 Still Imagery Data Interchange	Emerging	Commercial Electro-Optical Support Data Extensions (SDE) for the National Imagery Transmission Format Standard	Commercial SDE, Version 0.9, 25 September 1997; as documented in Section 7 of The Compendium of Controlled Extensions (CE) for the National Imagery Format Transmission Format (NITF), Version 1.0, 25 August 1998	ADDITION TO JTA. For systems which produce, disseminate, or use Commercial Satellite Imagery ONLY
2.2.3.3.5 Still Imagery Data Interchange	Emerging	(PROPOSED) NITF ISP of ISO/IEC International Standard 12087-5, Basic Image Interchange Format (BIIF)	Document under development	ADDITION TO JTA. BIIF, ISO/IEC IS 12087-5, Information Technology - Computer graphics and image processing - Image Processing Interchange (IP) - Functional specification - Part 5: Basic Image Interchange Format (BIIF), was published 1 December 1998. The ISP of BIIF will supersede MIL-STD-2500B, NITF 2.1

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.2.2.2.1.4.5.1.1 Video Imagery	Mandatory	DoD/IC/USIGS Video Imagery Standards Profile (VISP)	DoD/IC/USIGS Video Imagery Standards Profile (VISP) version 1.3, 6 March 1998	EXCEPTION TO JTA. This document is later version than the version referenced in the JTA. JTA 2.0 mandates 5 core standards from the VISP 1.21 and specifically omits VISP Recommended Profiles and Practices. The UTA mandates VISP 1.3, which includes the same base standards as the JTA, but also includes the Profiles and Practices NOT required by the JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	The Common Object Request Broker: Architecture and Specification	OMG document formal/98-02-01, CORBA/IIOP 2.2	EXCEPTION TO JTA. Later version than JTA mandate. JTA 2.0 mandates CORBA 2.1 Includes Interface Definition Language (IDL)
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	Fault Tolerance (ORB Enhancement) April 3, 1998	OMG document orbos/98-04-01, Fault Tolerance RFP	ADDITION TO JTA
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	IDL to Java (ORB Enhancement) January 19, 1998	OMG document orbos/98-01-06, Final Java/POA	ADDITION TO JTA
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	Java to IDL (ORB Enhancement) January 19, 1998	OMG document orbos/98-01-07, Java to IDL Revised; orbos/98-02-01, Revised Java to IDL Mapping; orbos/98-03-08, Errata to Java to IDL mapping	ADDITION TO JTA

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	Messaging Service (ORB Enhancement) March 7, 1996	OMG document orbos/98-05-06, Revised Messaging RFP submission; orbos/98-05-12, IDL files related to Messaging Revised Submission	ADDITION TO JTA
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	Multiple Interfaces and Composition (ORB Enhancement) January 11, 1996	OMG document orb/96-01-04, Revised Multiple Interfaces and Composition RFP	ADDITION TO JTA
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	Objects-by-Value (ORB Enhancement) January 19, 1998	OMG document orbos/98-01-01, Objects-by-Value Revised Submission; orbos/98-01-18, Joint Revised Objects-by Value Submission with Errata	ADDITION TO JTA
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	Tagged Data (ORB Enhancement) March 4, 1998	OMG document orbos/97-12-26, Tagged Data draft RFP; orbos/98-02-18, Tagged Data RFP Errata Sheet	ADDITION TO JTA
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Naming Service	OMG document formal/97-12-10, CORBAservices Naming Service	EXCEPTION TO JTA. This document is later version than the version referenced in the JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Event Service	OMG document formal/97-12-11, CORBAservices Event Service	EXCEPTION TO JTA. This document is later version than the version referenced in the JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Transaction Service	OMG document formal/97-12-17, CORBAservices Transaction Service	EXCEPTION TO JTA. This document is later version than the version referenced in the JTA.

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Object Collections	OMG document formal/97-12-24: CORBAservices Object Collections	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Concurrency Control Service	OMG document formal/97-12-14: CORBAservices - Concurrency Control Service	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Externalization Service	OMG document formal/97-12-15: CORBAservices - Externalization Service	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Life Cycle Service	OMG document formal/97-12-13: CORBAservices - Life Cycle Service	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Licensing Service	OMG document formal/97-12-19: CORBAservices - Licensing Service	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Property Service	OMG document formal/97-12-20: CORBAservices - Property Service	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Query Service	OMG document formal/97-12-18: CORBAservices - Query Service	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Relationship Service	OMG document formal/97-12-15: CORBAservices - Relationship Service.	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Security Service	OMG documents formal/97-12-22: CORBAservices - Security Service	ADDITION TO JTA. Augmentation of these specifications is expected in 1998 or 1999 to provide for greater levels of assurance.

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Time Service	OMG document formal/97-12-21: CORBAservices - Time Service	ADDITION TO JTA.
2.2.2.2.2.4.2 Distributed Object Computing	Mandatory	CORBAservices Trading Object Service	OMG document formal/97-12-23: CORBAservices - Trading Object Service	ADDITION TO JTA. (NOTE: This is also the ISO RM-ODP Trader Function)
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	CORBAservices Persistent State Service	OMG document orbos/98-05-10, Persistent State Service 2.0	ADDITION TO JTA This service will eventually replace the current CORBAservices Persistent Object Service, OMG document formal/97-12-12
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	DCE/CORBA Interworking Service	OMG document orbos/98-06-01, CORBAservices DCE/CORBA Interworking Service	ADDITION TO JTA
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	CORBAservices CORBA/Firewall Security	OMG document orbos/98-05-04, CORBAservices CORBA/Firewall Security	ADDITION TO JTA
2.2.3.5 Emerging Distributed (Object) Computing	Emerging	CORBAservices Interoperable Name Service	OMG document orbos/98-03-04, CORBAservices Interoperable Name Service	ADDITION TO JTA When approved, this specification will replace the CORBAservices Naming Service
2.3 INFORMATION TRANSFER STANDARDS				The UTA contains Additions, but no Exceptions to JTA mandated and emerging standards for Section 2.3
2.3.2.2.2.5 Asynchronous Transfer Mode (ATM)	Mandatory	Defense Information System Network (DISN) Asynchronous Transfer Mode (ATM) System Specification	DISN ATM System Specification, 17 April 1998	ADDITION TO JTA - This standard is only applicable to a subset of the USIGS: For system interface to DISN ONLY. Not identical to JTA 2.0 ATM mandates.

JTA Service Area & Section Number	USIGS Status	Standard Name(s)	Standard Document Identifier(s)	Remarks
2.3.2.2.2.5 Asynchronous Transfer Mode (ATM)	Mandatory	DoD Asynchronous Transfer Mode Standards	DoD ATM Standards, (version 1.0), 17 April 1998	ADDITION TO JTA - This standard is only applicable to a subset of the USIGS: For system interface to DISN ONLY. Not identical to JTA 2.0 ATM mandates.
2.4 INFORMATION MODELING, METADATA, AND INFORMATION EXCHANGE STANDARDS				There are no UTA exceptions or additions to JTA Mandated or Emerging standard(s) in JTA Section 2.4. USIGS Data Modeling standards are addressed in Section 5 of the UTA.
2.5 HUMAN-COMPUTER INTERFACE STANDARDS				There are no additions or exceptions to JTA Mandated Standard(s) in JTA Section 2.5. However, there are additions to the Emerging standards.
2.5. 3 Emerging (Symbology) Standards	Emerging	DoD Performance Specification Geospatial Symbols for Digital Displays (GeoSym™) DRAFT	MIL-PRF-89045, DoD Performance Specification Geospatial Symbols for Digital Displays (GeoSym™) DRAFT, 20 February 1998	ADDITION TO JTA. Supplements MIL-STD-2525A and supersedes DRAFT BIMA (Basic Imagery and Mapping Annotation) Graphics document. Approval expected in 1999.
2.6 INFORMATION SYSTEMS SECURITY STANDARDS				There are no UTA exceptions or additions to JTA Mandated or Emerging standard(s) in JTA Section 2.6.

3.4 Description of Specifications and Usage

This section provides textual descriptions for each standard in Table 3-1 and for additional JTA standards which are likely to be of interest to the USIGS community. The descriptions are provided for clarity and direction for USIGS developers and for program planning. The discussion is organized by JTA service area, to be consistent with the table. Each standard is referenced with a formal Title, Description, USIGS Status, and a Usage reference. All of the standards and specifications described in this section can be obtained in softcopy at the following URLs:

Geospatial Data Interchange (MIL-STDs, STANAG):	www.nima.mil
DIGEST:	www.digest.org
Still Imagery and Video Data Interchange:	www.ismc.nima.mil
Distributed Computing Services:	www.omg.org
DISN ATM:	www.disa.atd.net/DISNATM_DOCS
Geospatial Symbols for Digital Displays:	www.nima.mil

3.4.1 Additional IGC Standards

Section 3.4 includes additional standards descriptions not included in Table 3-1. These standards, listed in Table 3-2, are geospatial or imagery standards already covered in the DoD JTA 2.0 or are international standards of special developmental interest to the IGC.

Table 3-2. Additional IGC Standards

Standard	Referenced in:	Standard	Referenced in:
Vector Product Format	JTA	Bi-Level Image Compression for the NITF Standard	JTA
Raster Product Format	JTA	Common Warfighting Symbology	JTA
DoD World Geodetic System 1984	JTA	Basic Image Interchange Format (BIIF)	JTA emerging
Countries, Dependencies, Areas of Special Sovereignty and Their Principal Administrative Divisions	JTA	Digital Geographic Information Exchange Standard (DIGEST)	JTA emerging
JPEG for the NITF Standard	JTA	NIMA Tech Report for the DoD WGS	JTA emerging
Vector Quantization Decompression for the NITF Standard	JTA	NATO Secondary Imagery Format (NSIF), STANAG 4545	

3.4.2 Information Processing Standards

The UTA includes both Exceptions and Additions to the JTA 2.0 mandated standards in JTA Section 2.2. The UTA also includes additions to the JTA Section 2.2 emerging standards.

3.4.2.1 Graphics Data Interchange

USIGS developers will comply with the JTA for this service area with the exception of graphics formats which support the exchange of National Imagery Transmission Format (NITF) files. See UTA Section 3.4.3 for Computer Graphics Metafile (CGM) standards for USIGS systems producing, exchanging, or using NITFS files.

3.4.2.2 Geospatial Data Interchange

MIL-STD-2407, Interface Standard for Vector Product Format (VPF), 28 June 1996

Description: Vector Product Format (VPF) defines a common format, structure, and organization for data objects in large geographic databases that are based on a georelational data model and intended for direct use. VPF is designed to be compatible with a wide variety of applications and products. Existing geospatial products which implement VPF include:

Vector Smart Map (VMap) Levels 0-2

Urban Vector Smart Map (UVMap)

Digital Nautical Chart (DNC)

VPF Interim Terrain Data (VITD)

Digital Topographic Data (DTOP)

World Vector Shoreline Plus (WVS+)

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems which prepare or access digital geographic data in vector product format.

MIL-STD-2411A, Raster Product Format (RPF), 6 October 1994, with Notice of Change 1, 17 January 1995

Description: MIL-STD-2411A, the Raster Product Format (RPF), is a specification which defines a standard data structure for rectangular arrays of pixels. RPF is most often used for geospatial databases in compressed (using Vector Quantization) or uncompressed form. It is intended for data interchange and is designed to require no manipulation of the data, other than decompression, in order to use or

display it. MIL-STD-2411-1 is an accompanying standard to the RPF that defines registered data values to be used in RPF files. Existing geospatial products which implement RPF include:

Compressed Arc Digitized Raster Graphics (CADRG)

Controlled Image Base (CIB)

Digital Point Positioning Data Base (DPPDB).

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems which prepare or access digital geographic data in raster product format.

MIL-STD-2401, Department of Defense World Geodetic System (WGS-84), 11 January 1994

Description: The Department of Defense World Geodetic System (WGS 84), MIL-STD-2401, a Conventional Terrestrial Reference System (CTRS), specifies a standard global coordinate system for representation of a reference frame, reference ellipsoid, fundamental constants, and an Earth Gravitational Model with related geoid. Included in the Reference System are parameters for transferring to/from other geodetic datums. WGS 84 is the official DoD positional reference system. Navigation solutions from the NAVSTAR Global Positioning System (GPS) and the Navy Navigation Satellite System (NNSS) are referred to this system.

The technical content of WGS 84 is provided by DMA TR8350.2, DMA Technical Report - DoD World Geodetic System 1984, 1 September 1991. This Report has recently been updated and republished as NIMA TR8350.2, NIMA Technical Report - DoD World Geodetic System 1984, 4 July 1997. This new version of the report supersedes the earlier version.

USIGS Status: Mandatory

Usage: This standard applies to all DoD systems and products which require use of a world geodetic system; i.e., a consistent global coordinate system which allows an unambiguous representation of positional information. WGS 84 will be used for all joint operations and is recommended for use in multinational and unilateral operations after coordination with allied commands (CJCS).

FIPS PUB 10-4, Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions, April 1995

Description: FIPS PUB 10-4 provides a list of the basic geopolitical entities in the world, together with the principal administrative divisions that comprise each entity.

USIGS Status: Mandatory

Usage: For USIGS applications involving the interchange of geospatial information requiring the use of country codes.

STANAG 7074, Digital Geographic Information Exchange Standard (DIGEST) 2.0, June 1997

Description: The Digital Geographic Information Exchange Standard (DIGEST) was developed by the Digital Geographic Information Working Group (DGIWG) to support efficient exchange of Digital Geographic Information among nations, data producers, and data users.

The Digital Geographic Information Working Group (DGIWG) was established in 1983 to develop standards to support the exchange of Digital Geographic Information (DGI) among NATO nations. The DGIWG is not an official NATO body; however, the DGIWG's standardization work has been recognized and welcomed by the NATO Geographic Conference (NGC).

DIGEST is a comprehensive "family of standards" capable of supporting the exchange of raster, matrix, and vector data (and associated text) among producers and users. DIGEST can support the entire range of topological structures from no topology to full topology.

DIGEST is divided in 4 parts:

Part 1 consists of a brief general description of the standard.

Part 2 consists of the Theoretical Model, Exchange Structure, and Encapsulation specifications. The encapsulations include:

Annex A - based on ISO 8211.

Annex B - for telecommunication based on ISO 8824/5.

Annex C - Vector Relational Format (VRF).

Annex D - Image Interchange Format based on the NATO Secondary Imagery Format (NSIF) and the geopositioning parameters of DIGEST.

Annex E - Simple table of contents option for the data transmittal.

Part 3 consists of Codes, Parameters, and Tags.

Part 4 of DIGEST is the Feature and Attribute Coding Catalogue (FACC). FACC is a comprehensive coding scheme for features, their attributes and attribute values.

DIGEST has evolved to address new technologies and new geospatial requirements. Enhancements for version 2 include: imagery geopositioning; compression algorithm options via NATO Secondary Image Format (NSIF/STANAG 4545); mixing and alignment of various data types; compatibility with the National Imagery and Mapping Agency (NIMA) Vector Product Format (MIL-STD 2407); consistent Metadata across encapsulations; and a logical restructuring of the document. DGIWG is working closely with ISO TC 211 in the development of International Geospatial Standards and the migration of DIGEST as a profile of the ISO standards. Compatibility with other standards such as the NATO Secondary Imagery Format (NSIF), the International Hydrographic Organization S-57 Standard, and other International standards will continue to influence future versions of DIGEST.

Digital Geographic Information (or geospatial information) has evolved into an essential element in the planning and conduct of civil and military operations. The required data volume, demands and data complexity dictates the need for standards to assure interoperability and compatibility. DIGEST satisfies this need by defining those aspects necessary for the exchange of Digital Geographic/Geospatial Information such as data structures, format, feature coding scheme, exchange media, and administrative procedures.

Over the last few years DIGEST has become the basis for coproduction opportunities between nations. DIGEST-compliant datasets are being produced and exchanged by a number of nations to support a variety of military and civilian applications. DIGEST is a NATO standardization agreement (STANAG 7074). Industry continues to develop and promote commercial software based on compliance with DIGEST. NIMA Vector Product Format and NIMA's feature and attribute coding is based on DIGEST. The NATO Secondary Imagery Format (NSIF) points to DIGEST for georeferencing imagery. DIGEST/elements of DIGEST have been implemented by over 20 nations.

USIGS Status: Emerging

Usage: N/A

3.4.2.3 Still Imagery Data Interchange

Still Imagery refers to imagery where a likeness or representation of any natural or man-made feature or related object or activity and the positional data acquired at the same time was acquired, including products produced by space-based national intelligence reconnaissance systems, and likenesses or representations produced by satellites, airborne platforms, unmanned aerial vehicles, or other similar means. The Still Imagery standards in the DoD Joint Technical Architecture and the UTA are currently limited to the National Imagery Transmission Format Standard (NITFS).

The National Imagery Transmission Format Standard (NITFS) is a DoD and Federal Intelligence Community suite of standards for the exchange of digital still imagery products and image related products. Figure 3-1 diagrams the expected evolution of the NITFS.

NITFS provides a package containing information about the image, the image itself, and optional overlay graphics. The Standard provides a 'package' containing an image(s), subimages, symbols, labels, and text as well as other information related to the image(s). The NITFS suite is the standard for the exchange of USIGS Still Imagery. Refer to the National Imagery Transmission Format Standard (NITFS) Five Year Program Plan, Version 1.0, 1 July 1998 for an introduction to the NITFS suite of standards.

The NITFS Bandwidth Compression Standards and Guidelines, Version 1.0, 25 August 1998, covered in Section 5 of the UTA, defines the Bandwidth compression conventions and guidelines (such as "Downsample JPEG Compression – NIMA Method 4") required for use by the National Imagery Transmission Format Standard (NITFS).

MIL-STD-2500B, National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 22 August 1997 with Notice 1, 2 October 1998

Description: EXCEPTION TO JTA MANDATE (LATER VERSION). MIL-STD-2500B defines the NITF version 2.1, the standard file format for the exchange of imagery and imagery-related products to be used by the DOD and IC. MIL-STD-2500B is the United States' implementation of the NATO Secondary Imagery Format (NSIF) - STANAG 4545. NITF 2.1 is a part of the more inclusive National Imagery Transmission Format Standard (NITFS) and is used for transmission of still imagery and associated data. NITF 2.1 is the core of the NITF Suite of standards, and is coupled with additional standards for compression, graphics, and communications.

The NITF can be used to support interoperability by providing a data format for shared access applications, while also serving as a standard file format for the exchange of images, imagery derived intelligence, graphics, text, and associated data. The NITF is suitable for archiving imagery.

A NITF file supports the inclusion of three standard types of segments in a single file: image, graphic, and text segments. Additional types of data may be included in a NITF file by use of Extension Segments (ES).

MIL-STD-2500B shall be implemented in accordance with the National Imagery Transmission Format Standard (NITFS) Five Year Program Plan, Version 1.0, 1 July 1998, and MIL-HDBK-1300A.

NOTE: With the addition of the Notice 1 to MIL-STD-2500B, the NITF 2.1 standard and NATO STANAG 4545 (NATO Secondary Image Format/NSIF) are technically equivalent.

USIGS Status: Mandatory

Usage: NITF 2.1 is mandated for all C4I systems disseminating secondary imagery by the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)), and is required for interoperability within the USIGS when exchanging digital still imagery products and image related products. All new USIGS systems, and those undergoing major modification, shall conform to this standard.

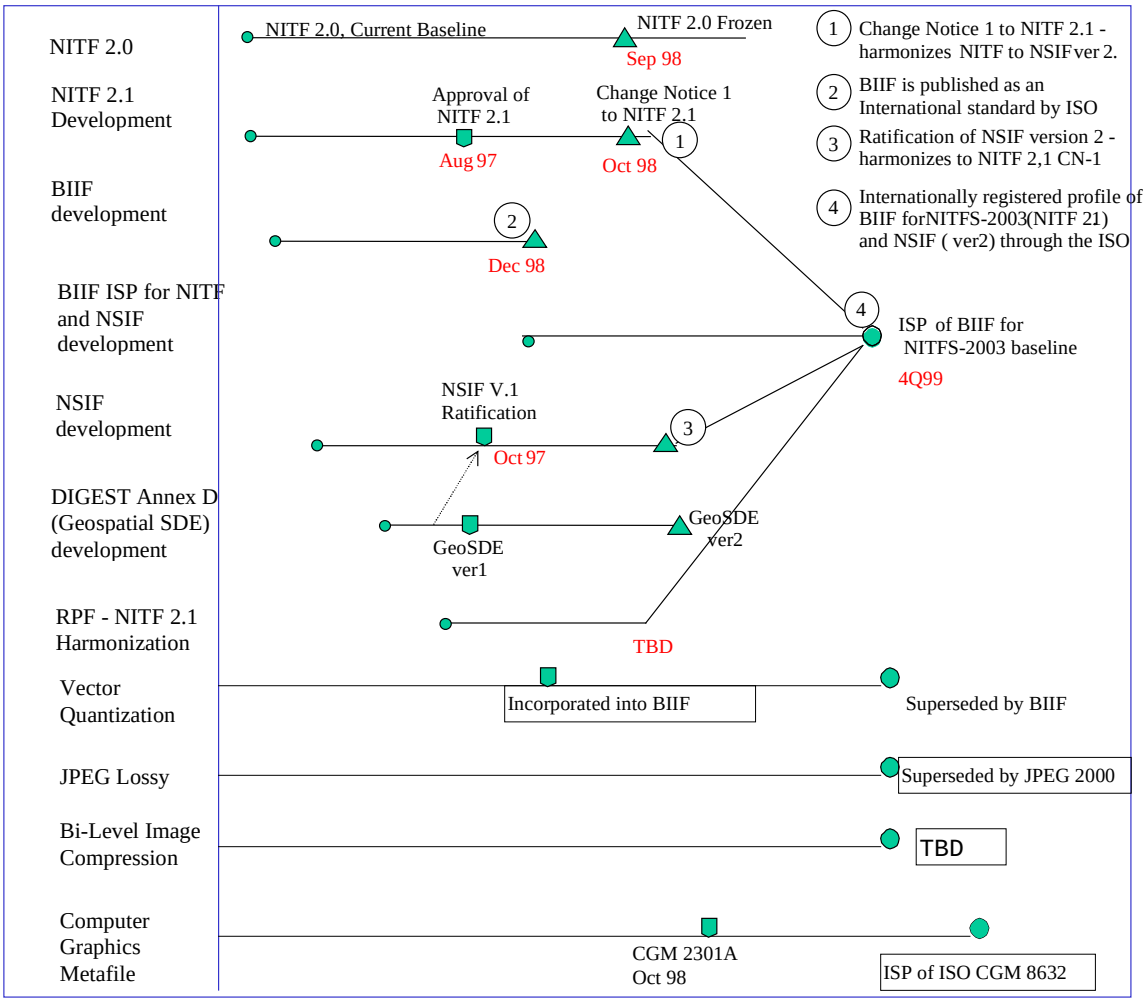


Figure 3-1. Expected Evolution of the NITFS

MIL-STD-2301A, Computer Graphics Metafile (CGM) Implementation Standard for the NITFS, 5 June 1998

Description: EXCEPTION TO JTA MANDATE (LATER VERSION). This standard defines a subset of Computer Graphics Metafile (CGM) commands applicable for graphic annotation of NITFS imagery. This standard is necessary to implement CGMs used for the representation of symbol graphics in the NITFS. MIL-STD-2301A enhances and expands the CGM capabilities in MIL-STD-2301, Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format (NITF) Standard, 18 June 1993. MIL-STD-2301A superseded MIL-STD-2301 on 1 October 1998, which coincides with the date on which MIL-STD-2500B, National Imagery Transmission Format Version 2.1 for the NITF Standard, 22 August 1997 superseded MIL-STD-2500A, National Imagery Transmission Format (Version 2.0) for the NITF Standard, 12 October 1994.

USIGS Status: Mandatory

Usage: This standard is applicable to the DoD and the Intelligence Community and is mandatory for all new or upgraded Secondary Imagery Dissemination Systems (SIDS) which exchange digital still imagery products and image related products. Use of MIL-STD-2301A will only be mandatory for NITF 2.1-compliant files. However, the content of 2301A included in the earlier 2301 standard is still required for processing NITF 2.0-formatted files.

MIL-STD-188-198A, Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, 15 December 1993 with NOTICE 1, 12 October 1994 and NOTICE 2, 14 March 1997

Description: This standard establishes the requirements to be met by systems complying with NITFS when image data are compressed using the JPEG image compression algorithm as described in DIS 10918-1, *Digital Compression and Coding of Continuous-tone Still Images*.

MIL-STD-188-198A provides technical detail of the NITFS compression algorithm designated by the code C3 in the Image Compression field of the National Imagery Transmission Format (NITF) file image subheader, JPEG, for both eight- and 12-bit gray scale imagery and 24-bit color imagery. It also provides the required default quantization tables for use in Secondary Imagery Dissemination Systems (SIDS) complying with NITFS.

The requirements specified in this standard are intended to enable the interchange of 8- and 12-bit gray scale imagery and 24-bit color imagery compressed with JPEG. This standard specifies two classes of encoding and decoding processes, lossy and lossless processes.

Follow-on(s) to 188-198A: Joint Photographic Experts Group (JPEG) 2000 is the title given to the follow-on to the currently defined NITFS JPEG standard, but which will be a wavelet based solution. A key feature of this compression is that it will be based on a "modular" architecture framework. This facilitates insertion of new technologies in the future, provides for flexibility, and facilitates the potential to "swap" modules based on compression requirements (quality, rate, etc.) of individual users.

The current schedule of activities for JPEG 2000 calls for a Draft International Standard (DIS) in November 1999, and a published International Standard available in November 2000. No format specification document exists at this time. Refer to the JPEG 2000 working group at www.ismc.nima.mil for additional information.

Multicomponent Joint Photographic Experts Group (JPEG) is being developed to provide support for multispectral, medical and color imagery as part of the JPEG 2000 effort. No format specification document exists at this time. Refer to the JPEG 2000 working group at www.ismc.nima.mil for additional information.

USIGS Status: Mandatory

Usage: MIL-STD 188-198A (JPEG) is the required lossy compression standard for 8-bit and 12-bit NITFS imagery within the USIGS and is required for all new or upgraded USIGS systems which exchange digital still imagery products and image related products.

MIL-STD-188-199, Vector Quantization Decompression for the National Imagery Transmission Format Standard, 27 June 1994 and NOTICE 1, 27 June 1996

Description: This standard describes the Vector Quantization (VQ) decompression algorithm for the National Imagery Transmission Format (NITF) file format and establishes its application within the NITFS. Vector Quantization (VQ) MIL-STD-188-199 is the mandated standard for decompressing NITF files compressed with VQ. Vector Quantization is a compression algorithm currently defined for multiband, color, and grayscale raster scanned maps and imagery. MIL-STD-188-199 establishes the requirements for the communication or interchange of image data in VQ compressed form.

Vector quantization is a lossy compression approach, chosen for use with certain types of image data because it can be implemented with acceptable performance and quality, because it provides a predictable compression ratio, and because decompression is very fast. The basic algorithm for the various types of imagery decompression is the same, and all information required for decompression of an NITF VQ file is contained within the NITF file itself.

USIGS Status: Mandatory

Usage: For all new or upgraded USIGS systems which exchange digital still imagery products and image related products. This standard is applicable to the IC and the DOD. VQ is mandatory for all Secondary Imagery Dissemination Systems (SIDS) in accordance with the memorandum by the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)). VQ compressed NITF files shall comply with MIL-STD-2500B and MIL-HDBK-1300A.

MIL-STD-188-196, Bi-Level Image Compression for the National Imagery Transmission Format Standard, 18 June 1993, and NOTICE 1, 27 June 1996

Description: This standard establishes the requirements to be met by NITFS systems when Still Image Data are compressed using the bi-level facsimile compression specified by the International Telecommunications Union (ITU) Telecommunication Standardization Sector (ITU-T) (formerly CCITT) Recommendation T.4 and MIL-STD-188-161C for Group 3 facsimile devices.

MIL-STD-188-196 establishes the requirements for the exchange of Still Image Data in compressed form. The bi-level compression standard may be operated in one of three modes:

mode 1 - one-dimensional coding.

mode 2 - two-dimensional coding with standard vertical resolution, K = 2.

mode 3 - two-dimensional coding with higher vertical resolution, K = 4

USIGS Status: Mandatory

Usage: Bi-level Image Compression, MIL-STD-188-196, is required for Bi-level (i.e., 1 bit per pixel, or black and white) lossless image compression as defined within the NITFS standard. MIL-STD-188-196 is mandatory for all Secondary Imagery Dissemination Systems in accordance with the memorandum by

the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)). For image Data greater than one bit pixel, other NITFS specified compression algorithms should be used.

MIL-STD-188-197A, Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) 12 Oct 1994

Description: ADDITION TO JTA. This standard establishes the requirements to be met by complying with NITFS systems when NITF 1.1 image data are compressed using the Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) compression algorithm. ARIDPCM is a spatial compression algorithm currently defined for 8- and 11-bit gray scale images.

This standard provides technical detail of the NITFS compression algorithm designated by the code C2 in the image compression field of the image subheader, ARIDPCM, for both 8- and 11-bit gray scale imagery. It also provides the required default ARIDPCM quantization.

The ARIDPCM defined by this standard consists of three parts: the compressed data interchange format which defines the image data field of the NITF file format, the encoder, and the decoder. Two types of operation are specified by the acquisition authority.

Type 1 - 8-bit sample compression

Type 2 - 11-bit sample compression

USIGS Status: Mandatory

Usage: ARIDPCM, removed as a required compression for the NITF 2.1, is now only required for use with *ingesting and decompressing legacy files* (NITF 1.1). NITF 2.0 (MIL-STD-2500A) and NITF 2.1 (MIL-STD-2500B) requires all new or upgraded USIGS systems which exchange digital still imagery products and image related products to decompress using ARIDPCM for backward-compatibility with version 1.0 of the NITF standard.

(PROPOSED) NITF ISP of ISO/IEC International Standard 12087-5, NITF International Standardized Profile of Part 5: BASIC IMAGE INTERCHANGE FORMAT (BIIF)

Description: ADDITION TO JTA. THIS IS A PROPOSED STANDARD; NO FORMAL DOCUMENT EXISTS AT THIS TIME. BIIF is an international standard, approved on 1 December 1998, which provides a commercial/international foundation for interoperability in the interchange of imagery and imagery-related data among applications. BIIF provides a data format container for image, symbol, and text, along with a mechanism for including image-related support data.

As part of the 12087 family of image processing and interchange standards, BIIF conforms to the architectural and data object specifications of 12087-1, the Common Architecture for Imaging. BIIF supports a profiling scheme that is a combination of the approaches taken for 12087-2 (PIKS), 10918 (JPEG), 8632 (CGM), and 9973 (The Procedures for Registration of Graphical Items).

BIIF, the international version of NITF, is equivalent, but not identical, to NITF 2.1 (MIL-STD-2500B - See NITF 2.1 for more information). It is intended that profiles of the BIIF will be established as an International Standardized Profile (ISP) through the normal ISO processes (ISO/IEC TR 10000). A USIGS profile of BIIF, technically equivalent to the NITF 2.1 standard, will be created with the expectation that this profile will eventually supersede MIL-STD-2500B as a UTA mandate. This BIIF Profile will not require software upgrades in USIGS systems in order to maintain interoperability with the NITF MIL-STD. Refer to the National Imagery Transmission Format Standard (NITFS) Five Year Program Plan, Version 1.0, 1 July 1998 for more information on the BIIF profile development process.

USIGS Status: Emerging

Usage: N/A

STANAG No. 4545, Edition 1, 27 November 1998 NORTH ATLANTIC TREATY ORGANISATION (NATO) MILITARY AGENCY FOR STANDARDIZATION (MAS) STANDARDIZATION AGREEMENT (STANAG) SUBJECT: NATO Secondary Imagery Format (Format d' Imagerie Secondaire OTAN)

Description: ADDITION TO JTA. STANAG 4545 defines the NATO Secondary Imagery Format (NSIF), the NATO standard file format for imagery and imagery-related products. The NSIF provides a common standard for storage and interchange of images and associated data among existing and future systems and is the standard for formatting digital imagery files and imagery-related products and exchanging them among NATO members. The NSIF can be used to support interoperability by simultaneously providing a data format for shared access applications, while also serving as a Standard NSIF File Format for dissemination of images graphics, text, and associated data.

For the NSIF, the image data encompasses multispectral imagery and images intended to be displayed as monochrome (shades of grey), colour-mapped (pseudocolour), or true colour and may include grid or matrix data intended to provide additional geographic or geo-referencing information. Graphic data is used in the NSIF to store two-dimensional information represented as a CGM. The graphic format is CGM as described in ISO/IEC 8632-1. The precise tailoring of the CGM standard to NSIF is found in MIL-STD-2301A.

Among NATO nations, many kinds of systems are used for the reception, transmission, storage, and processing of images, graphics, text, and other associated data. Without special efforts, the NSIF File Format used in one system is likely to be incompatible with the format of another system. Since each system may use a unique, internal data representation, a common format for exchange of information across systems is needed for interoperability of systems within and among NATO nations.

When systems use other than NSIF as an internal imagery format, each system will have to translate between the system's internal representation for files, and the NSIF File Format. A system from which imagery data is to be transferred is envisioned to have a translation module that accepts information, structured according to the system's internal representation for images, graphics, text, and other associated data, and assembles this information into one file in the Standard NSIF File Format. Then the NSIF File will be exchanged with one or more recipients. Each of the receiving systems will translate the data from the NSIF File into its internal format.

NOTE: With the addition of the MIL-STD-2500B, NITF 2.1 Notice 1, 2 October 1998 and the approval of STANAG 4545, Edition 1, the NITF 2.1 standard and NATO STANAG 4545 (NSIF) are technically equivalent.

USIGS Status: Emerging

Usage: The NSIF will be used for transmission and storage of Secondary Imagery within and among NATO C3I nodes.

ICHIPB Support Data Extensions for the National Imagery Transmission Format, 16 November 1998

Description: ADDITION TO JTA. ICHIPB is a system-independent NITF Support Data Extension (SDE) that, when included with NITF image chips, will support the USIGS mensuration of image chips. The ICHIPB NITF SDE supports the generation of required data for imagery mensuration for exploiters of non-dewarped imagery chips. The ICHIPB holds the support data that analysts need when using imagery software to mensurate or determine detailed geospatial parameters on pixel based features within image chips. There is no mechanism in the standard NITF format to pass a standardized set of data with an image chip such that a user can easily apply imagery software to that image.

The proposed ICHIPB SDE is an attempt to standardize the solution so that any recipient of an image, regardless of system or application, will be able to access the necessary mensuration support data and exploit the image chip in a uniform and consistent manner.

ICHIPB will be incorporated into the next published version of The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF).

USIGS Status: Mandatory

Usage: This standard is only applicable to a subset of the USIGS: For systems which produce, disseminate, or use National Technical Means (NTM), Tactical/Airborne imagery, or Commercial Satellite imagery ONLY. To maintain interoperability within the USIGS, ICHIPB should be included with all non-dewarped NITF chips, specifically when the chip is disseminated. It is recommended that it not be included with dewarped images. NITF receiving systems will be expected to read and interpret the information within ICHIPB if they have requirements to mensurate on the received image chip.

NITF Profile for Imagery Access Extensions (PIAE) 3.0, 25 September 1997, as documented in the Section 6 of the Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF), Version 1.0, 25 August 1998

Description: ADDITION TO JTA. This support extension is designed to provide an area to place fields not currently carried in NITF but which were documented in the now superseded Standards Profile for Imagery Access (SPIA). This extension was developed to align the SPIA and NITF for product information, and adds descriptive detail associated with products.

USIGS Status: Mandatory

Usage: This standard is only applicable to a subset of the USIGS: For new or upgraded USIGS systems which produce, disseminate, or use National Technical Means (NTM), Tactical/Airborne imagery, or Commercial Satellite imagery using the NITFS suite of standards ONLY.

Synthetic Aperture Radar (SAR) Support Data Extensions (SDE) for the National Imagery Transmission Format Standard, 20 May 1996 as documented in Section 8 of the Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF), Version 1.0, 25 August 1998

Description: ADDITION TO JTA. The SAR SDE describes specific tagged records which incorporate all Support Data Extensions relevant to primary imagery processed from Synthetic Aperture Radar (SAR) data.

SAR Related Support Data Extensions

AIMIDA Additional Image Identification

EXPLTA Exploitation Related Information

BLOCKA Image Block Information

SECTGA Secondary Targeting Info

MPDSRA Mensuration Data

MENSRA Airborne SAR Mensuration Data

ACFTA Aircraft Information

PATCHA Patch Information

MTIRPA Moving Target Information

USIGS Status: Mandatory

This standard is only applicable to a subset of the USIGS: For new and upgraded USIGS systems which produce, disseminate, or use Tactical/Airborne SAR imagery formatted according to NITF 2.X.

Visible, Infrared, and Multispectral Airborne Sensor Support Data Extensions (SDE), 25 September 1997, as documented in Section 10 of the Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF), Version 1.0, 25 August 1998

Description: ADDITION TO JTA. This document specifies the format and content of a set of controlled tagged record extensions for the National Imagery Transmission Format (NITF v2.X) file format. These support data extensions are defined for use with visible (i.e., electro-optical (EO)),

infrared (IR) and multispectral imagery (MSI) collected on airborne sensor platforms. The specified tagged records incorporate all Support Data Extensions (SDE) relevant to visible/infrared/multispectral/ hyperspectral (EO-IR-MSI-HSI) primary. However, the primary sources are not yet explicitly included. Systems using visible, or infrared imagery formatted according to NITF 2.X, obtained from airborne sensors, should be designed to extract the needed data from the tagged records.

Sensors collecting imagery also collect and report auxiliary data that uniquely identifies the imagery, defines the collection geometry, and contains other information to aid exploitation of that imagery. The extensions described herein define the format for that support information within a NITF 2.X file containing visible or infrared imagery.

Tag Title	Requirement
AIMID Additional Image Identification	Required
ACFT Aircraft Information	Required
BLOCK Image Block Information	Optional
SECTG Secondary Targeting Info	Optional
BANDS Multispectral Band Parameters	Optional
EXOPT Exploitation Usability Optical Info	Optional
MSTGT Mission Target	Optional
RPC00 Rapid Positioning Data	Optional
SENSR EO-IR Sensor Parameters	Required
STERO Stereo Information	Optional

USIGS Status: Mandatory

Usage: ADDITION TO JTA. This standard is only applicable to a subset of the USIGS: For new or upgraded USIGS systems which produce, disseminate, or use Tactical/Airborne imagery ONLY, having a requirement to support airborne EO-IR and multispectral imagery. These systems shall conform to the NITF 2.X standard, including the SDEs described in this section. Tactical Airborne sensor platforms collecting the imagery are excluded from this mandate.

HISTOA Softcopy History Tag, as documented in Section 15 of the Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF), Version 1.0, 25 August 1998

Description: The purpose of the tag is to provide a history of the softcopy processing functions that have been applied to NITF imagery. Although the tag was originally designed for National System Imagery, it

can also be used to record the softcopy processing history of airborne and commercial imagery, provided that the imagery is processed in a manner consistent with the Softcopy History Tag. Ideally, the tag would be created whenever a National, airborne, or commercial image is formatted in NITF and updated each time the image is processed and saved by a softcopy processing system.

USIGS Status: Mandatory

Usage: ADDITION TO JTA. For systems which produce, disseminate, or use National Technical Means (NTM) ONLY.

Commercial SDE, Version 0.9, 25 September 1997; as documented in Section 7 of The Compendium of Controlled Extensions (CE) for the National Imagery Format Transmission Format (NITF), Version 1.0, 25 August 1998

Description: This SDE documents a set of controlled tagged record extensions for the National Imagery Transmission Format (NITF v2.X) file format. These extensions describe the format for support information within a NITF 2.X file containing commercial imagery.

USIGS Status: Emerging

Usage: ADDITION TO JTA. For systems which produce, disseminate, or use Commercial Satellite Imagery ONLY. Primary collection systems are excluded from this mandate.

3.4.2.4 Motion Imagery/Video Data Interchange

Video is defined as Electro-Optical motion imagery technologies defined by standards developed by ISO, ITU, SMPTE, EBU, etc., reviewed, adopted and profiled for various applications. Video systems are further subdivided into (4) categories:

Video Imagery Systems

Video Teleconference Systems

Video Telemedicine Systems

Video Support Services

3.4.2.4.1 Video Imagery Data Interchange

Video Imagery Systems create, transmit, edit, store, archive or disseminate digital video for real-time, near-real time or for other end-user product distribution, usually in support of Intelligence, Surveillance, and Reconnaissance (ISR) activities. Video, and more specifically “video imagery,” is classified as a subset of motion imagery in the DoD JTA and the UTA.

DoD/IC/USIGS Video Imagery Standards Profile (VISP), Version 1.3, 6 March 1998

Description: EXCEPTION TO JTA (LATER VERSION). The JTA 2.0 mandates 5 core standards from the VISP 1.21 and specifically omits VISP Profiles and Practices. The UTA mandates VISP 1.3, which includes the same base standards as the JTA, but also includes the Profiles and Practices NOT required by the JTA. Therefore, this mandate is additive to the existing JTA 2.0 mandate; it is non-conflicting.

The Video Imagery Standards Profile (VISP) 1.3 mandates the minimum set of standards and interoperability profiles for the acquisition of all DoD, Intelligence Community and IGC systems that produce, use, or exchange Video Intelligence information.

The VISP provides a consolidated, clear and concise view of the standards needed to build and operate Video Imagery systems within USIGS. The VISP includes guidance on uncompressed, compressed, and related video sampling structures; video time standards, video metadata standards, interconnections, and common language descriptions of video system parameters. All of the technology outlined in the VISP document is based on commercially available (or very near term available) systems and components based on defined Open Standards.

The VISP documents:

- Approved Commercial Standards, Interoperability Profiles and Recommended Practices for DoD/IC/USIGS implementations

- Emerging Standards, Profiles, and Recommended Practices that are still in Study Status

- Video System Description Recommended Practices that include both Approved and Study status elements.

Where the term Recommended Practice is used, the VISP item documents a recommended implementation or practice that further clarifies the implementation of a Standard or Profile in order to insure interoperability across DoD/IC/USIGS systems.

Where the term Study is used, the VISP identifies a *preliminary* version of an anticipated and or emerging Standard, Profile, or Recommended Practice where the primary initial parameters are outlined and understood but additional coordination or engineering analysis is required.

USIGS Status: Mandatory

Usage: All USIGS component systems that create, process, transmit, manipulate, exploit, store, archive and disseminate (both for real-time and other end-user wide area product distribution) video signals in support to Intelligence, Reconnaissance, and Surveillance (ISR) applications will comply with the Standards and Interoperability Profiles contained in VISP.

All USIGS video systems should also comply with VISP Recommended Practices if possible.

3.4.2.5 Distributed Computing Services

In the area of distributed computing, USIGS has designated CORBA 2.2 [CORBA98] as the environment in which it will deliver these services. The Technical Reference Model (TRM) discussion in Section 2 stresses a service-oriented software environment, a software component architecture, and interoperability through software re-use and standard interfaces. The appropriate CORBAservices and CORBAfacilities are identified and defined.

3.4.2.5.1 Remote Procedure Computing

Although the USIGS profile for distributed computing services profiles CORBA 2.2, there is current work developing interfaces between both DCE (which is based on remote procedure computing) and OLE/COM and CORBA.

3.4.2.5.2 Distributed Object Computing

The mandate for distributed object computing is interworking with the Object Management Group (OMG) Object Management Architecture (OMA), composed of the Common Object Request Broker Architecture (CORBA), CORBAservices, and CORBAfacilities.

CORBA - defines the interfaces and services for Object Request Brokers, including an Interface Definition Language (IDL) and the Internet Inter-ORB Protocol (IIOP).

CORBAservices - defines interfaces and semantics for services required to support distributed objects, such as naming, security, transactions, and events.

CORBAfacilities - defines interfaces and semantics for services required to support functions such as compound document manipulation.

The CORBA interoperability mandate does not preclude the use of other distributed object technologies, such as ActiveX/DCOM or Java, as long as the capability for interworking with CORBA applications and objects is maintained by the non-CORBA system. *Interworking* is the exchange of meaningful information between computing elements (semantic integration). Application Level Interworking, for CORBA, results in CORBA clients interacting with non-CORBA servers and non-CORBA clients interacting with CORBA servers. For OLE/COM, Application Level Interworking results in COM/OLE clients interacting with non-COM/OLE servers and non-COM/OLE clients interacting with COM/OLE servers. Products are available that allow interworking among distributed object techniques.

USIGS will comply with the DoD JTA in using CORBA and the associated Interface Definition Language (IDL) and Internet inter-ORB protocols (IIOP), but exceeding the JTA mandate by specifying the latest version of CORBA, version 2.2.

The Object Management Architecture describes the Object Request Broker (ORB), which allows objects to communicate over a distributed environment. There are also several categories of object interfaces, one of which is called Object Services (CORBAservices). These Object Services are interfaces which

support general interfaces likely to be used in most programs which rely on distributed objects. Both the Joint Technical Architecture, in Section 2.2, and the UTA, in Section 3, address ORB and CORBAservices specifications. The remaining categories of object interfaces are part of the Application Software Entity and are addressed in Section 4 of the UTA.

3.4.2.5.2.1 Object Request Broker (CORBA)

OMG document formal/98-02-01, CORBA/IIOP 2.2, The Common Object Request Broker: Architecture and Specification

Description: EXCEPTION TO JTA (LATER VERSION). JTA 2.0 mandates CORBA 2.1. CORBA is a common object request broker architecture based on the Object Management Architecture use of object technologies. The architecture and specifications described CORBA/IIOP 2.2 are aimed at software designers and developers who want to produce applications that comply with OMG standards for the Object Request Broker (ORB) including an Interface Definition Language (IDL). As defined by the Object Management Group (OMG) in the *Object Management Architecture Guide,* the ORB provides the mechanisms by which objects transparently make requests and receive responses. The ORB provides interoperability between applications on different machines in heterogeneous distributed environments and seamlessly interconnects multiple object systems.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document orbos/98-04-01, Fault Tolerance Request for Proposal (RFP), April 3, 1998

Description: ORB Enhancement. The Fault Tolerance RFP addresses the need to standardize CORBA functions supporting fault tolerant applications, when clients of these applications will be isolated from details such as management of redundant copies, failure masking, and recovery. The RFP also addresses systems where the applications, or some third-party software, requests additional control over fault management.

USIGS Status: Emerging

Usage: N/A

OMG document orbos/96-08-01, IDL to Java Request for Proposal (RFP), August 1, 1996

Description: ORB Enhancement. This RFP requests technology that provides a Java language mapping for the OMG Interface Definition Language (IDL) specification language. The Java Mapping specification is to provide the ability to access and implement CORBA objects within programs written in Java.

Three separate Revised Submissions have been received to date.

USIGS Status: Emerging

Usage: N/A

OMG document orbos/97-03-08, Java to IDL Request for Proposal (RFP), January 19, 1998

Description: ORB Enhancement. The RFP addresses the need to enhance the CORBA Java language mapping with an Java-IDL mapping. A Java to IDL mapping will allow developers to build distributed applications directly in Java and communicate via IIOP.

USIGS Status: Emerging

Usage: N/A

OMG document orbos/96-03-16, Messaging Service Request for Proposal (RFP), March 7, 1996

Description: ORB Enhancement. RFP requests services or ORB enhancements designed to manage asynchronous messages in distributed object systems, including the ordering and quality of service of request.

Submissions have been received:

orbos/98-05-12, IDL files related to the Messaging Revised Submission, May 18, 1998

orbos/98-05-06, Revised Messaging RFP submission with changebars and attached errata explanation, May 18, 1998

USIGS Status: Emerging

Usage: N/A

OMG document orbos/96-01-04, Multiple Interfaces and Composition Request for Proposal (RFP), January 11, 1996

Description: ORB Enhancement. The RFP deals with the resolution of conflict between multiple IDL interfaces to the same object. The Composition facility will provide the means for objects to be composed of logically distinct services by the use of multiple interface definitions. Multiple Revised submissions have been received.

USIGS Status: Emerging

Usage: N/A

OMG document orbos/96-06-14, Objects by Value Request for Proposal (RFP)

Description: ORB Enhancement. This RFP seeks proposals for interfaces which provide for the passing of CORBA objects by value (rather than by reference) as parameters in CORBA object operations. Passing objects by value is more efficient and straightforward in many circumstances.

Revised Submissions:

orbos/98-01-18 (Joint Revised Objects-by-Value Submission with Errata), January 19, 1998

orbos/98-01-01 (Objects-by-Value Revised Submission), January 19, 1998

USIGS Status: Emerging

Usage: N/A

OMG document orbos/97-12-26, Tagged Data Request for Proposal

Description: ORB Enhancement. The RFP requests the development of a specification for a tagged data capability that supports arbitrary items of data of in-memory size, where each data value is tagged for identification. The goal is to develop an interface that will provide a standardized way of creating, accessing, updating, and manipulating these arbitrary data structures or objects.

USIGS Status: Emerging

Usage: N/A

3.4.2.5.2.2 Object Services (CORBAServices)

CORBA is a common object request broker architecture based on the Object Management Architecture use of object technologies. The object services associated with CORBA 2.2 are commonly referred to as CORBAservices and are a collection of services (interfaces and objects) that support basic functions for using and implementing objects. CORBAservices are described in the CORBAservices*: Common Object Services Specification, November 1997* document. CORBAservices are necessary to construct any distributed application and are *always independent* of application domains. The interface designs of all the services are general in nature and do not require specific supporting software in order to implement. Each specification of an Object Service usually consists of a set of interfaces and a description of the service's behavior.

The CORBAservices summarized include:

Mandatory:

Naming Service, Licensing Service, Event Service, Property Service, Transaction Service, Query Service, Object Collections, Relationship Service, Concurrency Control Service, Security Service, Externalization Service, Time Service, Life Cycle Service, Trading Object Service

Emerging:

DCE/CORBA Interworking, Persistent State Service 2.0, Firewall RFP, Interoperable Name Service, Fault Tolerance

Each CORBA Services document, description, and their USIGS status is provided below:

OMG document formal/97-12-10, CORBAservices Naming Service

Description: EXCEPTION TO JTA (LATER VERSION). The Naming Service provides the ability to bind a name to an object relative to a naming context. A naming context is an object that contains a set of name bindings in which each name is unique.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-11, CORBAservices Event Service

Description: EXCEPTION TO JTA (LATER VERSION). The Event Service supports Asynchronous events and reliable event delivery.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-17, CORBAservices Transaction Service

Description: EXCEPTION TO JTA (LATER VERSION). The Object Transaction Service supports interoperability between different programming models. For instance, some users want to add object implementations to existing procedural applications and to augment object implementations with code that uses the procedural paradigm. To do so in a transaction environment requires the object and procedural code to share a single transaction. The Transaction Service supports multiple transaction models, including the flat (mandatory in the specification) and nested (optional) models

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-24, CORBAservices Object Collections Service

Description: ADDITION TO JTA. Collections are groups of objects which, as a group, support some operations and exhibit specific behaviors that are related to the nature of the collection rather than to the type of object they contain. Examples of collections are sets, queues, stacks, lists, and binary trees. The purpose of the Object Collections Service is to provide a uniform way to create and manipulate the most common collections generically.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-14, CORBAservices Concurrency Control Service

Description: ADDITION TO JTA. The Concurrency Control Service enables multiple clients to coordinate their access to shared resources. Coordinating access to a resource means that when multiple, concurrent clients access a single resource, any conflicting actions by the clients are reconciled so that the resource remains in a consistent state.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-15, CORBAservices Externalization Service

Description: ADDITION TO JTA. The Externalization Service defines protocols and conventions for externalizing and internalizing objects. Externalizing an object is to record the object state in a stream of data (in memory, on a disk file, across the network, and so forth) and then be internalized into a new object in the same or a different process. The externalized object can exist for arbitrary amounts of time, be transported by means outside of the ORB, and be internalized in a different, disconnected ORB. For portability, clients can request that externalized data be stored in a file whose format is defined with the Externalization Service Specification.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-13, CORBAservices Life Cycle Service

Description: ADDITION TO JTA. The Life Cycle Service defines conventions for creating, deleting, copying and moving objects.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-19, CORBAservices Licensing Service

Description: ADDITION TO JTA. The Licensing Service provides a mechanism for producers to control the use of their intellectual property. Producers can implement the Licensing Service as needed, because the Licensing Service does not impose its own business policies or practices.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-20, CORBAservices Property Service

Description: ADDITION TO JTA. Property Service provides the ability to dynamically associate named values with objects outside the static IDL-type system.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-18, CORBAservices Query Service

Description: ADDITION TO JTA. The Query Service allows users and objects to invoke queries on collections of other objects. These queries are declarative statements with predicates and include the ability to: specify values of attributes; to invoke arbitrary operations; and to invoke other Object Services. The Query Service allows indexing and correlates well to the query mechanisms used in database systems and other systems that store and access large collections of objects.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-15, CORBAservices Relationship Service

Description: ADDITION TO JTA. The Relationship Service allows entities and relationships to be explicitly represented. Entities are represented as CORBA objects. This Service defines two new kinds of objects: relationships and roles. A role represents a CORBA object in a relationship. The Relationship interface can be extended to add relationship-specific attributes and operations. In addition, relationships of arbitrary degree can be defined. Similarly, the Role interface can be extended to add role-specific attributes and operations.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG documents formal/97-12-22, CORBAservices Security Service

Description: ADDITION TO JTA. The Security Service supports:

- Identification and authentication of human users, and objects, which need to operate under their own rights to verify who they claim to be.
- Authorization and access control - deciding whether a principal can access an object, normally using the identity and/or other privilege attributes of the principal (such as role, groups, security clearance) and the control attributes of the target object (stating which principals, or principals with which attributes) can access it.
- Security auditing to make users accountable for their security related actions. Auditing mechanisms should be able to identify the user correctly, even after a chain of calls through many objects.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-21, CORBAservices Time Service

Description: ADDITION TO JTA. Time Service enables the user to obtain current time together with an error estimate associated with it. The Time Service also ascertains the order in which “events” occurred, generates time-based events based on timers and alarms, and computes the interval between two events.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document formal/97-12-23, CORBAservices Trading Object Service

Description: ADDITION TO JTA. The Trading Object Service provides a matchmaking service for objects. The Service Provider registers the availability of the service by invoking an export operation on the trader, passing as parameters information about the offered service. The export operation carries an object reference that can be used by a client to invoke operations on the advertised services, a description of the type of the offered service (i.e., the names of the operations to which it will respond, along with their parameter and result types), information on the distinguishing attributes of the offered service.

USIGS Status: Mandatory

Usage: All new or upgraded USIGS systems

OMG document orbos/98-05-10, CORBAservices Persistent State Service 2.0

Description: ADDITION TO JTA. The Persistent State Service provides a set of common interfaces to the mechanisms used for retaining and managing the persistent state of objects.

This specification is proposed to replace the earlier, approved Persistent Object Service (POS). The POS, adopted 3 years ago, could not be implemented due to major flaws.

USIGS Status: Emerging

Usage: N/A

OMG document orbos/98-06-01, CORBAservices DCE/CORBA Interworking Service

Description: ADDITION TO JTA. The DCE/CORBA Interworking Service provides CORBA objects with access to DCE application servers and the standard DCE CDS (Cell Directory Service). The service may be used for CORBA clients since there is no requirement for clients to have non-CORBA capabilities in order to use the Interworking Service

USIGS Status: Emerging

Usage: N/A

OMG document orbos/98-05-04, CORBAservices CORBA/Firewall Security

Description: ADDITION TO JTA. The CORBA/Firewall Security service describes changes to CORBA that are needed for ORBS to function in a modified manner so that CORBA communications can be handled by firewalls. The service also describes how current firewall techniques can be used to control CORBA communications. It adds to CORBA new data elements that provide clients, firewalls, and servers additional needed for firewall traversal and also defines the CORBA interfaces that can be used with CORBA software to provide information to a firewall.

USIGS Status: Emerging

Usage: N/A

OMG document orbos/98-03-04, CORBAservices Interoperable Naming Service

Description: ADDITION TO JTA. See CORBAservices Naming Service specification described earlier. This document is expected to eventually supersede the CORBAservices Naming Service specification.

USIGS Status: Emerging

Usage: N/A

3.4.3 Information Transfer Standards

The UTA contains Additions, but no Exceptions to JTA mandated and emerging standards for Section 2.3.

3.4.3.1 Secondary Imagery Dissemination Communications

MIL-STD-2045-44500, National Imagery Transmission Format Standard (NITFS) Tactical Communications Protocol 2 (TACO2), 18 June 1993; with Notice of Change 1, 29 July 1994, and Notice of Change 2, 27 June 1996

Description: The Tactical Communications Protocol 2 (TACO2) is the communications component of the National Imagery Transmission Format Standard (NITFS) suite of standards used to disseminate secondary imagery. TACO2 is used over point-to-point tactical data links in high BER disadvantaged communications environments.

USIGS Status: Mandatory

Usage: TACO2 is used to transfer secondary imagery and related products where JTA transfer protocols are not applicable (e.g., TACO2 only applies to users having simplex and half-duplex links as their only means of communications).

Defense Information System Network (DISN) Asynchronous Transfer Mode (ATM) System Specification, Version 1.2c, 17 April 1998

Description: ADDITION TO JTA. This specification describes and defines subsystems, functions, interface requirements and performance requirements for DISN ATM subsystems to support services via a DISN ATM infrastructure. The document is intended as guidance for acquiring or leasing functional subsystems and/or component elements of the DISN. ATM is a high-speed switched data transport

technology that takes advantage of primarily low bit error rate transmission media to accommodate intelligent multiplexing of voice, data, video, imagery, and composite inputs over high-speed trunks and dedicated user links. Asynchronous Transfer Mode (ATM) is a transfer mode in which information is organized into cells and is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic.

For all other applications (non-DISN), refer to the DoD JTA ATM standards.

USIGS Status: Mandatory

Usage: This standard is only applicable to a subset of the USIGS: For new or emerging USIGS systems with an interface to DISN.

DoD ATM Standards, (version 1.0), 17 April, 1998

Description: ADDITION TO JTA. This specification is an approved profile of ATM standards for DISN and systems interfacing with DISN ONLY. In order to support DoD and other systems interfacing with the DISN, DISA mandates the standards in this document for major interfaces and ATM applications identified within. This document specifies minimum standards and requirements for DISN ATM systems, equipment, and services for the interfaces and the applications.

For all other applications (non-DISN), refer to the DoD JTA ATM standards.

USIGS Status: Mandatory

Usage: This standard is only applicable to a subset of the USIGS: For new or emerging USIGS systems with an interface to DISN.

3.4.4 Information Modeling, Metadata, and Information Exchange Standards

There are no UTA Section 3 exceptions or additions to JTA Mandated or Emerging standard(s) in JTA Section 2.4. USIGS developers will comply with the JTA for these services. However, USIGS Data Modeling and Metadata standards are addressed in Section 5 as UTA Conventions.

3.4.5 Human-Computer Interface Standards

There are no additions or exceptions to JTA Mandated Standard(s) in JTA Section 2.5. However, there are additions to the Emerging standards. USIGS developers will refer to the JTA mandates for this service area. See [JTA98] Section 2.5.

MIL-STD-2525A, Common Warfighting Symbology, 15 December, 1996 with NOTICE 1, 10 July 1997

Description: MIL-STD-2525A is the standard symbol set for all future DoD C4I Warrior symbology applications. The symbol set is compliant with the Computer Graphics Metafile (CGM) standard. The CGM provides a file format suitable for the storage and retrieval of picture information. The file format consists of a set of elements that can be used to describe pictures in a way that is compatible between systems of different architectures and devices of differing capabilities and design.

USIGS Status: Mandatory

Usage: All new or upgraded DoD systems

MIL-PRF-89045, DoD Performance Specification Geospatial Symbols for Digital Displays (GeoSym™) DRAFT, 20 February 1998

Description: ADDITION TO JTA. This specification defines the format and content of the symbol graphics and symbol assignment tables that comprise the Geospatial Symbols for Digital Displays products. GeoSym™ symbols were created for use with Vector Product Format (VPF™) products. However, GeoSym™ symbols may be used to display many types of digital data, not only VPF™. GeoSym™ was compiled from hundreds of symbols in existing paper and digital symbology standards and are rendered in Computer Graphics Metafile (CGM) format, using the ISO CGM specification. GeoSym™ was designed to complement the symbols in *Common Warfighting Symbology*, MIL-STD-2525A. The current draft version of GeoSym™ is intended to support the symbolization of the following VPF™ products:

- Digital Flight Information Publication (DFLIP™)
- Digital Nautical Chart (DNC™)
- Digital Topographic Data - Mission Essential Data Set (DTOP™-MEDS)
- Littoral Warfare Data (LWD™)
- Tactical Ocean Data (TOD™)
- Urban Vector Smart Map (UVMap™)
- VPF Interim Terrain Data (VITD™)
- Vector Smart Map Level 0 (VMap 0™)
- Vector Smart Map Level 1 (VMap 1™)
- Vector Smart Map Level 2 (VMap 2™)
- Vector Vertical Obstruction Data (VVOD™)
- World Vector Shoreline Plus (WVS*PLUS*™)

Symbols for nautical and hydrographic features in GeoSym™ prototype are compliant with the International Hydrographic Organization's S-52 standard for Electronic Chart Display and Information System (ECDIS) symbols. The IHO S-52 standard for ECDIS symbols requires that each symbol be

rendered with colors appropriate for the various lighting conditions that exist on a ship's bridge throughout the day.

There are three basic feature delineation types in the specification: area symbols, lines symbols, and points symbols. Several sources of graphic symbols were used in the development of GeoSym™. The primary sources used for a feature symbolization was based one the feature's allocation into one of three categories:

Land: Symbols for most land features were derived from the military standard, Standard Practice for Mapping, Charting & Geodesy Symbols for Graphic Products, MIL-STD-2402.

Sea: The symbols specified in the International Hydrographic Organization's, *Specifications for Chart Content and Display Aspects of ECDIS*, also called the IHO S-52 Standard, were selected for hydrographic and bathymetric features, as well as many land features that are found on the DNC™ and TOD™ products.

Air: The symbols for many aeronautical navigation aids, flight routes and other aeronautical features were derived from the *Aerospace Recommended Practice, Electronic Aeronautical Symbols* developed by the Aerospace Behavioral Engineering Technology Committee of the Society of Automotive Engineers. Some aeronautical symbols were also derived from the symbols used on NIMA's DFLIP™ product.

USIGS Status: Emerging

Usage: N/A

3.4.6 Information System Security Standards

There are no UTA exceptions or additions to JTA Mandated or Emerging standard(s) in JTA Section 2.6. USIGS developers will refer to the JTA for this service area. See [JTA98] Section 2.6.

This Page Intentionally Left Blank

4. Application Software Entity Standards

The architectural approach taken for the USIGS emphasizes the use of components—small, simple building blocks that can be assembled into more complex software entities. The use of software components has become a standard approach to building applications programs. The USIGS components within the Application Software Entity fall into two major categories (consistent with the DoD Technical Reference Model): Mission Area Applications and Support Applications. Support Applications are then subdivided into Common Support Applications, Common Facilities, and Domain Objects (or Shared Domain Services in the OGC Services Architecture).

- **Mission Area Applications** (subsection 4.1) are applications programs that often include a user interface and perform specific operations that are required for specific missions. These applications invoke Common Facilities, Domain Objects, and Object Services as required. On occasion, a Mission Area Application may also invoke the services of a Common Support Application. The term "Mission Area Application" relates to "Mission Application" in the DII COE architecture model and to "Application Object" in OMG's Object Management Architecture (OMA).
- **Support Applications** (subsection 4.2) are the second major partition within the Application Software Entity of the DoD TRM. For USIGS, this category has been further divided into:

    1. **Common Support Applications** (subsection 4.2.1) are application programs that often include a user interface, are used regardless of mission, and include office automation software such as word processors, spreadsheet programs, presentation authoring programs, etc. These applications invoke Common Facilities, Domain Objects, and Object Services as required.

    2. **Common Facilities** (subsection 4.2.2) are components that are invoked by application programs in order to provide a specific service or set of services that are of general utility. These components invoke other Common Facilities, Domain Objects, and Object Services as required. They are invoked by Mission Area Applications, Common Support Applications, Domain Objects, and other Common Facilities.

    3. **Domain Objects** (subsection 4.2.3) are components that are invoked by application programs in order to provide a specific service or set of services that are applicable to or within a single information domain. These components invoke other Domain Objects, Common Facilities, and Object Services as required. They are invoked by Mission Area Applications, Common Support Applications, Common Facilities, and other Domain Objects.

Thus, Application Software Entity standards refer to *interfaces* that are borne by components that are used to build applications, *not the applications themselves*. Hence, most of the discussion in this section will address interface standards for Common Facilities and Domain Objects. Mission Area and Common Support Applications will use these interfaces as required, so no specific standards are identified for them.

Figure 4-1 is a modification of the Object Management Group's (OMG's) Object Management Architecture (OMA). It depicts the software entities listed above within the context of USIGS. The distributed object bus and component interfaces enable the integration of both COTS and GOTS software components in the construction of Mission Area Applications. The distributed object bus is implemented by various commercially-available, CORBA-compliant Object Request Brokers (ORBs). The ORB provides an infrastructure allowing the various software components or objects to communicate, independent of the specific platforms, programming languages, or operating systems involved. The figure also reflects current efforts to develop a set of APIs (GIAS and GIXS) that provide open, standardized interfaces to geospatial exploitation and information access services.

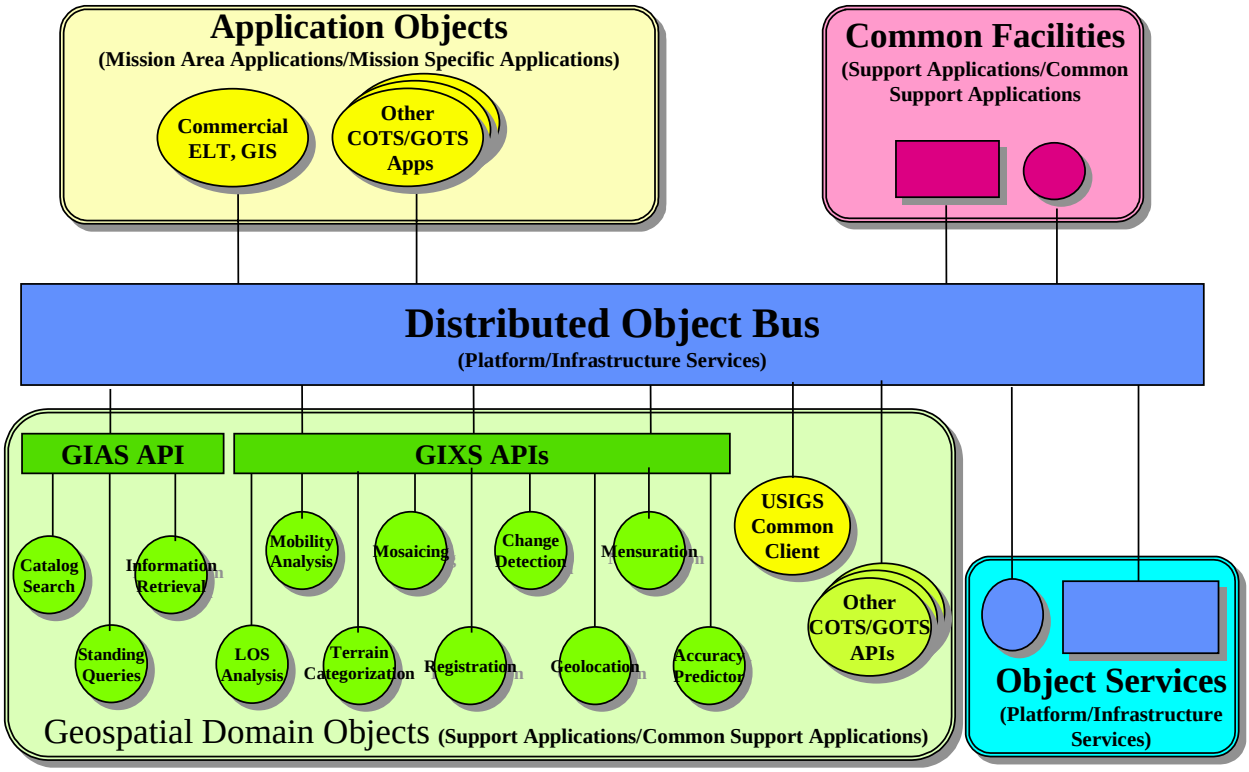


Figure 4-1. OMA Applied to USIGS (a Work in Progress)

4.1 Mission Area Applications

Mission Area Applications are components that bear no interfaces, but may use services in the MCG&I domain among others. There are no specific standards for Mission Area Applications.

4.2 Support Applications

4.2.1 Common Support Applications

Common Support Applications typically have a user interface, but bear APIs for use by other components. Some, however, bear APIs in lieu of user interfaces. In these cases there may be standards

for these APIs, but most are proprietary, product-specific APIs for which little more than the APIs, themselves, are published.

4.2.2 Common Facilities Standards

This subsection lists and discusses all Common Facilities that are mandated or emerging relative to the USIGS. To date, all Common Facilities identified for the USIGS have been, or are in the process of being, defined by the OMG. Common Facilities are components with generic capabilities and are not specific to any one information domain. For instance, the Printing Facility is expected to be used by all applications whether they are Mission Area or Common Support Applications. Typically, products based on Common Facilities interfaces are available as separate shrink-wrapped products or bundled with other products, such as the bundling of the Printing Facility with a printer. Table 4-1 lists the following information for each standard or specification:

- The specification name
- The specification status: 'P' designates a public specification, 'E' indicates that proposals for the specification have been submitted but none has been selected, and blank indicates that a Request for Proposals has been issued but proposals have not yet been received
- The USIGS status: 'M' designates Mandatory, and 'E' Emerging
- The date of the document containing the specification
- Relevant documents.

Table 4-1. Common Facilities Specifications

Standard/ Specification	Spec Status	USIGS Status	Document Date	Relevant Documents
Control and Mgmt of Audio/Video Streams	P	E	September 23, 1997 (Revision expected 4Q 1998)	OMG telecom/97-05-07 OMG telecom/97-06-04 (Errata OMG telecom/97-05-07)
Mobile Agents Facility	P	E	February 10, 1998	OMG orbos/97-10-05 (Update of Revised MAF Submission)
Meta Object Facility (MOF)	P	E	November 19, 1997	OMG ad/97-08-14 (Revised MOF Submission) OMG ad/97-09-04 (Errata to OMG ad/97-08-14) OMG ad/97-08-15 (Appendix to OMG ad/97-08-14)

Standard/ Specification	Spec Status	USIGS Status	Document Date	Relevant Documents
System Management Facility	P	M	November 21, 1996	OMG 1995/95-12-02 (X/Open Sysman RFC Submission copyright information) OMG 1995/95-12-03 (X/Open Sysman RFC Cover pages) OMG 1995/95-12-04 (X/Open Sysman RFC Front pages) OMG 1995/95-12-05 (X/Open Sysman RFC Main text) OMG 1995/95-12-06 (X/Open Sysman RFC Index)
Common Management Facilities	P	M	September 23, 1997	Systems Management: Common Management Facilities (XCMF), Open Group CAE Specification C423
Unified Modeling Language	P	E	November 19, 1997	OMG ad/97-08-02 (UML Proposal Summary (1 of 10)) OMG ad/97-08-03 (UML Summary (2 of 10), v1.1) OMG ad/97-08-04 (UML Semantics and appendices (3 of 10), v1.1) OMG ad/97-08-05 (UML Notation Guide (4 of 10), v1.1) OMG ad/97-08-06 (UML Extension for Objectory Process for Software Engineering (5 of 10), v1.1) OMG ad/97-08-07 (UML Extension for Business Modeling (6 of 10), v1.1) OMG ad/97-08-08 (Object Constraint Language Specification (7 of 10), v1.1) OMG ad/97-08-09 (OA&D CORBAfacility (8 of 10), v1.1)

Standard/ Specification	Spec Status	USIGS Status	Document Date	Relevant Documents
CORBA Component Model	E	E	June 27, 1997 (RFP) Nov 9 & 10, 1997 (Initial Submissions)	OMG orbos/97-06-12 (CORBA Component Model RFP, Final Version) OMG orbos/97-11-03 (Data Access Submission to Components, Scripting, and Multiple Interfaces and Comp. RFPs (combined)) OMG orbos/97-11-04 (SSA Initial Submission to the CORBA Component RFP) OMG orbos/97-11-07 (DSTC Initial Submission to the Components RFP) OMG orbos/97-11-23 (Expersoft Initial Submission to the Component Model RFP) OMG orbos/97-11-24 (Joint Initial Submission to the Components Model RFP -- BEA Systems, ICL, IONA, International Business Machines, Netscape Communications, Oracle, SunSoft, Unisys, Visigenic Software) OMG orbos/97-11-35 (Rogue Wave Revised Initial Submission to CORBA Component RFP) OMG orbos/97-12-21 (Combined Inline Software/Genesis Submission to Multiple Interfaces and Component RFPs)
CORBA Scripting Language	E	E	June 27, 1997 (RFP) July 6, 1998 (Revised Submission)	OMG orbos/97-06-13 (CORBA Scripting Language RFP, Final Version) OMG orbos/98-07-02 (Revised Scripting Language Submission)
Printing Facility	P	E	July 28, 1998	OMG orbos/98-02-12 (Errata to the Printing Facility Revised Submission) OMG orbos/98-01-05 (Xerox Revised Printing Facility Submission)
Stream-based Model Interchange		E	December 1997	OMG ad/97-12-03 (Stream-based Model Interchange Format RFP)

4.2.2.1 Control and Management of Audio/Video Streams

Description: The Control and Management of Audio/Video Streams specification addresses 12 issues:

1. Topologies for streams
2. Multiple flows

3. Stream description and typing
4. Stream interface identification and reference
5. Stream set-up and release
6. Stream modification
7. Stream termination
8. Multiple protocols
9. Quality of service
10. Flow synchronization
11. Interoperability
12. Security

This document specifies a set of interfaces that implement a distributed media streaming framework. The principal components of the framework are:

- Virtual Multimedia Devices and Multimedia device - represented by the VDev and MMDevice interfaces respectively
- Streams - represented by the `StreamCtrl` interface
- Stream endpoints - represented by the `StreamEndPoint` interfaces
- Flows and flow endpoints - represented by `FlowConnection` and `FlowEndPoint` interfaces respectively
- Flow Devices - Represented by the `FDev` interface.

A *stream* represents continuous media transfer, usually between two or more *virtual multimedia devices*. A *stream endpoint* terminates a stream. A simple stream between a microphone device (audio source or producer) and speaker device (audio sink or consumer) is shown in Figure 4-2.

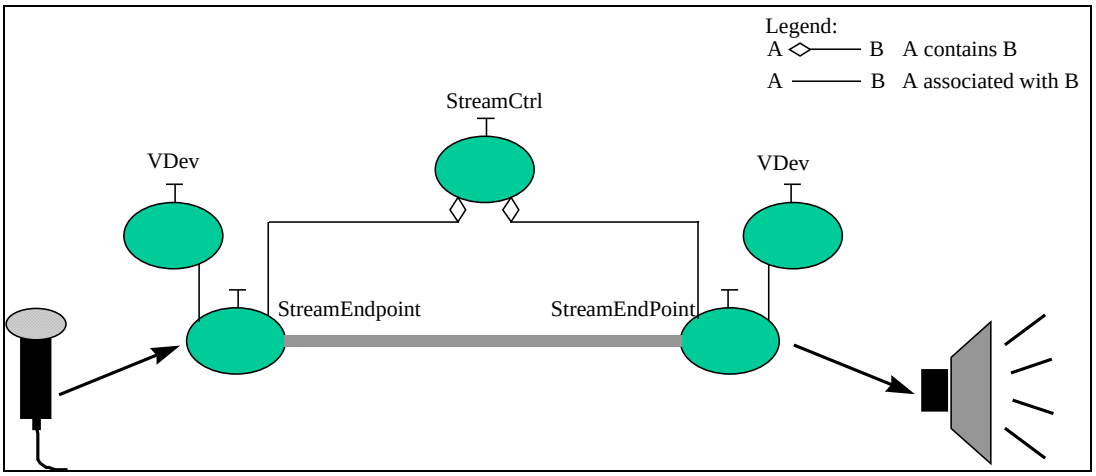


Figure 4-2. A Basic Stream Configuration

A stream may contain multiple *flows*. Each flow carries data in one direction so a flow endpoint may be either a source (producer) or a sink (consumer). An operation on a stream (for example, *stop* or *start*) may be applied to all flows within the stream simultaneously or just a subset of them. A stream endpoint may contain multiple flow endpoints. Both flow producer endpoints and flow consumer endpoints may be contained in the same stream endpoint. There may be a CORBA object representing each flow endpoint and *flow connection* (i.e. the flow itself), but not all systems are required to expose IDL interfaces to these flow objects. Figure 4-3 illustrates a stream which consists of several different flow connections. Note that not all flow endpoints are involved in the stream, i.e. there may be 'dangling' flow endpoints. Note also that flows can travel in both directions within the same stream. When two stream endpoints that support separate flow endpoints are bound, a compatibility rule can be used to determine which flow endpoints connect to each other.

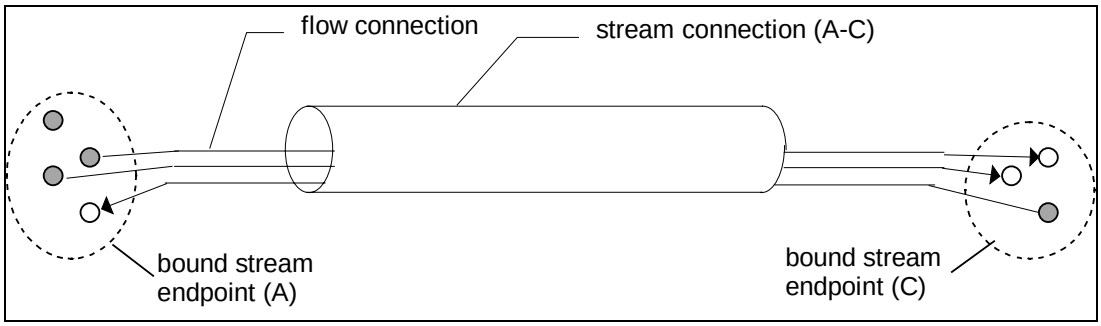


Figure 4-3. Stream Connection Compatibility Rules Can Allow Unconnected Flow Endpoints

A *multimedia device* abstracts one or more items of multimedia hardware and acts as a factory for *virtual multimedia devices*. A multimedia device can support more than one stream simultaneously; for example, a microphone device streaming audio to two speaker devices using separate non-multicast connections. For each stream connection requested, the multimedia device creates a stream endpoint and a virtual multimedia device.

The specification discusses each of the main IDL interfaces in detail. There are two basic 'profiles' for the streaming service:

- The 'full profile' in which flows endpoints and flow connections have accessible IDL interfaces. This profile is optimized for flexibility.

- The 'light' profile in which flows endpoints and flow connections do not expose IDL interfaces. The light profile is a subset of the full profile. It is optimized for systems that need to minimize memory footprint and the number of CORBA invocations.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.2.2 Mobile Agents Facility

Description: Mobile agents (also called transportable agents) are a relatively new technology that is fueling a new industry. Because the technology and the industry are new, mobile agent systems (for example, Crystaliz's MuBot, Dartmouth College's AgentTcl, IBM's Aglets, the Open Group's MOA, GMD FOKUS's JMAF/Magna, and General Magic's Odyssey) differ widely in architecture and implementation.

The differences among mobile agent systems prevent interoperability and rapid proliferation of agent technology, and has probably impeded the growth of the industry. To promote both interoperability and system diversity, some aspects of mobile agent technology must be standardized.

An important goal in mobile agent technology is interoperability between various manufacturers' agent systems. Interoperability becomes more achievable if actions such as agent transfer, class transfer, and agent management are standardized. When the source and destination agent systems are similar, standardization of these actions can result in interoperability. However, when the two agent systems are dramatically different, only minimal interoperability can be achieved.

Interoperability in this specification is not about language interoperability. Mobile Agent System Interoperability Facilities (also called MAF, an acronym for the original proposal, Mobile Agent Facility) is about interoperability between agent systems written in the same language, but potentially by different vendors and systems that are expected to go through many revisions within the lifetime of an agent. Language interoperability for active objects that carry "continuations" around is technically difficult to achieve. Furthermore, it is not needed, because the support for different languages can be replicated at each node.

This specification does not define standardization of local agent operations such as agent interpretation, serialization, execution, or deserialization. However, these actions are implementation-specific, and there is currently no compelling reason to limit agent system implementations to a single architecture.

There are several areas of mobile agent technology that the document specifies to promote interoperability:

- Agent management
- Agent transfer
- Agent and agent system names
- Agent system types
- Location syntax

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.2.3 Meta Object Facility (MOF)

Description: The Meta Object Facility (MOF) provides a CORBA-compliant architecture for defining and sharing semantically rich metadata in distributed heterogeneous environments. This submission is intended to be a foundation for sharing metadata across the life cycle in component-based and object-oriented development.

A key goal of the MOF specification is to provide extensibility and self-discovery in systems. This goal is achievable because the MOF interfaces can be used to discover new extensions and new components that are being constantly introduced in distributed environments.

Another goal of the MOF specification is to provide the specification of rich semantics to enable two systems or applications to meaningfully share information. This goal is achieved by providing domain-specific metamodels (such as the OA&D metamodel - UML) that conform to the MOF metamodeling architecture. Note that CORBA uses the Dynamic Invocation Interface (DII) for discovery of CORBA interfaces and the proposed CORBA Component Model RFP (work in progress) also addresses the self-discovery (introspection) of CORBA components.

Similar specific mechanisms can be found in Microsoft COM and various proprietary repository and tool implementations. The MOF addresses the discovery of metadata in general, and addresses the broader issues of rich semantic metadata interoperability typical in development, data warehouse and business object environments. It is expected that discovery interfaces optimized for specific purposes (as in Java Beans) will use standard CORBA services and mechanisms, such as the MOF-to-IDL mapping in this specification, to coexist and interoperate with general MOF interfaces.

Typically, the MOF will be used for manipulating meta objects to provide integration of tools and applications across the life cycle using industry standard metamodels, such as the OMG UML. Proliferation of systems dependent on standard metadata services, such as the MOF together with industry standard metamodels such as UML, accelerates the market for component software in general and model driven component software development, because components meeting specific semantics and requirements can be discovered using the MOF interfaces. Additional work in the areas of standard

metamodels for database technologies, component management and tracking, transaction discovery and legacy integration is expected in the future.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.2.4 System Management Facility

Description: The OMG System Management Facility is a profile of the Open Group's Systems Management Reference Model and consists of three basic components:

- Managers which implement Management Tasks and other composite management functions.
- Managed Objects which encapsulate resources. Resources are the entities within a system or network of systems that require management.
- Services which provide the X/Open System Management (XSM) Support Environment. The XSM Support Environment consists of the capabilities and interfaces that are necessary to support the other components of the Reference Model.

Management Facilities are a category of services which have been specialized for XSM distributed system management. This document specifies a set of management facilities that supplement the OMG Object Model so that it supports the Open Group's System Management Reference Model. The Open Group's Systems Management Reference Model provides a complete description of the mapping to the OMG Object Model.

This specification presents a set of management services that integrate with the OMG environment and provide extended services specifically for the distributed system management. These services, in conjunction with the OMG environment, are fundamental to provide a framework for developing distributed system management applications.

The management facilities specified assume an OMG CORBA compliant ORB and a compliant implementation of the CORBA Object Services. This implies the management facilities described in the specification may use types and interfaces defined in OMG standard header files (for example, <orb.idl>). The components addressed in this specification are those focused on the management of policy-driven objects including the mechanisms and facilities that enable the establishment and enforcement of policy on these objects.

This specification also fully backs the application portability and internationalization efforts of the Open Group. In areas where the Open Group has defined standards, these standards are used. Examples are the X/Open Portability Guide, Issues 3 and 4. Adhering to these specifications is critical to all implementations and the interfaces for a system administration framework must enable the use and accommodation of these specifications.

USIGS Status: Mandatory

Usage: This specification has been mandated for use within the USIGS. However, a profile of this specification for USIGS is required.

4.2.2.5 Common Management Facilities

Description: This specification extends and contains additional APIs for the System Management Services defined above.

USIGS Status: Mandatory

Usage: This specification has been mandated for use within the USIGS. However, a profile of this specification for USIGS is required.

4.2.2.6 Unified Modeling Language (UML)

Description: The Unified Modeling Language (UML) and corresponding facility interface definition are comprehensive. However, these specifications are packaged so that subsets of the UML and facility can be implemented without breaking the integrity of the language.

The UML Semantics is packaged as shown in Figure 4-4.

This packaging shows the semantic dependencies between the UML model elements in the different packages. The IDL in the facility is packaged almost identically. The notation is also “packaged” along the lines of diagram type. Compliance to the UML is thus defined along the lines of semantics, notation, and IDL, in the following sections:

- Compliance to the UML Semantics
- Compliance to the UML Notation
- Compliance to the UML Extensions
- Compliance to the OA&D CORBAfacility Interface

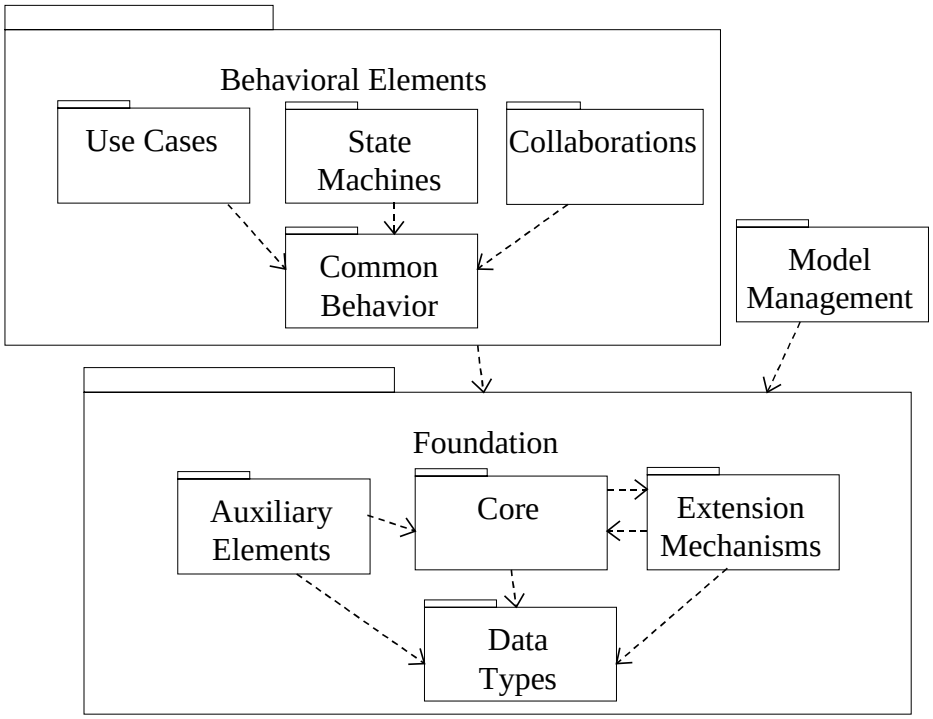


Figure 4-4. UML Class Diagram Showing Package Structure

Even if the compliance points are decomposed into more fundamental units, vendors implementing UML may choose not to fully implement this packaging of definitions, while still faithfully implementing some of the UML definitions. However, vendors who want to precisely declare their compliance to UML should refer to the precise language defined herein, and not loosely say they are "UML compliant."

The UML and MOF are based on a four-layer metamodel architecture, where the MOF meta-metamodel is the meta-metamodel for the UML metamodel. As a result, the UML metamodel may be considered an *instance-of* the MOF meta-metamodel. This is sometimes referred to as *loose (or "non-strict") metamodeling*, where a M_n level model is an instance of a M_{n+1} level model. Since the MOF and OA&DF have different scopes, and diverge in the area of relationships, it has not been possible to apply *strict metamodeling*. In strict metamodeling, every element of a M_n level model is an instance of exactly one element of M_{n+1} level model. Consequently, there is not a strict isomorphic mapping between all the MOF meta-metamodel elements and the UML meta-metamodel elements. In principle, strict metamodeling is difficult (or sometimes impossible to accomplish) as the complexity of new concepts (for example patterns and frameworks) continues to increase. In any case, using a small set of primitive concepts such as those defined in the MOF, it is possibly to define arbitrarily complex metamodels. In spite of this, since the two models were designed to be interoperable, the two metamodels are structurally quite similar. Association classes are also discussed.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the

specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.2.7 CORBA Component Model

Description: The OMG has solicited proposals for a distributed component model based upon the OMA, and that is capable of inter-operating with other emerging component technologies, particularly the JavaBeans component model.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.2.8 CORBA Scripting Language

Description: CORBA Scripting Language is part of a coordinated strategy to introduce a component model into the OMA. The scripting language will be capable of scripting CORBA components.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however**.**

4.2.2.9 Printing Facility

Description: This facility handles management (scheduling, spooling, locating) of print servers and routing of print jobs. The printing facility is able to meet a range of printing requirements from simple documents up to high volume production printing.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.2.10 Stream-based Model Interchange

Description: This asks for a stream-based model interchange format (SMIF) and solicits proposals for a transfer format specification for file export/import of models, and a transfer format specification for unique identification of the version of the MOF meta-metamodel and any metamodels referenced but not included in an SMIF-compliant transfer.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3 Domain Object Specifications

This subsection lists and discusses all Domain Objects that are mandated or emerging relative to the USIGS. Those of greatest concern to USIGS are those in the MCG&I domain (specifically the MCG&I domain services being defined by NIMA and the OGC). Interfaces from other information domains are listed as well, since not all operations within the USIGS are specific to the MCG&I information domain. In many cases, specifications have been developed for other information domains that may be profiled to satisfy USIGS requirements.

Table 4-2 lists the following information for each domain object standard or specification:

- The applicable domain
- The specification name
- The specification status: 'P' designates a public specification, 'E' indicates that proposals for the specification have been submitted but none has been selected, and blank indicates that a Request for Proposals has been issued but proposals have not yet been received
- The USIGS status: 'M' designates Mandatory, and 'E' Emerging
- The date of the document containing the specification
- Relevant documents.

Table 4-2. Domain Object Specifications

Domain	Standard/ Specification	Spec Status	USIGS Status	Document Date	Relevant Documents
MCG&I	Geospatial and Imagery Access Services (GIAS)	P	M		NIMA USIGS GIAS Specification, Version 3.2, 28 July 1998 [GIAS98]
	Open GIS Simple Feature	P	E		OGC, *The OpenGIS Specification Model, Topic 5: The OpenGIS Feature*, Version 3, Doc. No. 98-105, 1998
	Geospatial and Imagery eXploitation Services (GIXS)	E	E		NIMA USIGS GIXS Specification, Draft Version 0.7, 5 June 1998 [GIXS98]
Business Objects	Common Business Objects	P	E	July 27, 1998	OMG bom/98-07-14: Task and Session CBO's errata OMG bom/98-07-05: Task and Session CBOs revised Submission

Domain	Standard/ Specification	Spec Status	USIGS Status	Document Date	Relevant Documents
	Workflow Management Facility	E	E	May 9, 1997 (RFP) March 9, 1998 (Revised Submissions)	OMG cf/97-05-06 (Workflow RFP) OMG bom/98-03-01 (Nortel Revised Submission to the Workflow Management RFP) OMG bom/98-03-04 (JFLOW revised submission -- CSE Systems, CoCreate Software, Concentus Technology, DSTC, Data Access, Digital Equipment, EDS, FileNet, Fujitsu, Genesis Development Corporation, Hitachi, IABG, ICL, International Business Machines, Oracle, Plexus, SSA, Siemens Nixdorf Informationssysteme, Xerox)
	Calendar Facility		E	December 5, 1997	OMG bom/97-12-07 (Calendar Facility RFP)
Manufac-turing	PDM Enablers	P	E	July 28, 1998	OMG mfg/98-02-01 (Errata to document mfg/98-01-01) OMG mfg/98-01-01 (Joint Revised PDM Enabler Submission)
Electronic Commerce	Electronic Payment	P	E	June 15, 1998	OMG ec/98-06-06 (Oracle/Tandem Revised Electronic Payment Submission)
	Negotiation Facility	P	E	June 27, 1997 (RFP) June 8, 1998 (Initial Submissions)	OMG ec/98-02-04 (Revised Negotiation RFP (Updated submission schedule)) OMG ec/97-06-05 (Negotiation Facility RFP) OMG ec/98-06-02 (OSM/Inline Software Joint Initial Submission to the Negotiation RFP) OMG ec/98-06-03 (Negotiation Facility CDL) OMG ec/98-06-04 (Negotiation Facility IDL)

Domain	Standard/ Specification	Spec Status	USIGS Status	Document Date	Relevant Documents
Finance	Currency	P	E	July 28, 1998	OMG finance/98-04-01 (Errata 3.0 to the Currency Revised Submission) OMG finance/98-03-03 (Revised Currency Submission)
	Party Management	E	E	June 27, 1997 (RFP) March 9, 1998 (Revised RFP) July 6, 1998 (Revised RFP	OMG finance/97-06-04 (Party Management RFP, Final Version) OMG finance/98-03-02 (Party Management Facility Submission) OMG finance/98-07-05 (Joint Initial Party Management Submission)
Healthcare	Person Identification Service	P	E	July 28, 1998	OMG corbamed/98-02-29 (Final adopted PIDS specification including errata sheets)
	Lexicon Query Service	P	E	July 28, 1998	OMG corbamed/98-03-22 (Lexicon Query Service, final Submission)
	Clinical Observations		E	Dec 5, 1997 (RFP) May 19, 1998 (Initial Submissions)	OMG corbamed/97-12-28 (Clinical Observations Access Service (COAS) RFP) OMG corbamed/98-05-05 (Initial Clinical Observations RFP Submission, update with minor editorial changes)
	Healthcare Resource Access Controls		E	February 13, 1998 (RFP)	OMG corbamed/98-02-23 (Healthcare Resource Access Control RFP)
	Healthcare Data Interpretation		E	April 3, 1998 (RFP)	OMG orbamed/98-03-30 (Health data Interpretation Facility RFP) OMG corbamed/98-03-29 (Health Data Interpretation Facility RFP, abbreviated version)

Domain	Standard/ Specification	Spec Status	USIGS Status	Document Date	Relevant Documents
Telecommunications	Notification Service	P	E	July 28, 1998	OMG dtc/98-04-01 (Errata #2 to the Notification Service) OMG telecom/98-03-05 (Errata to Telecom Joint Notification Submission (telecom/98-01-01)) OMG telecom/98-01-01 (Revised Joint Notification Service Submission)
	Telecom Log Service		E	February 13, 1998 (RFP) July 6, 1998 (Initial Submission)	OMG telecom/98-02-11 (Telecom Management Log Service RFP) OMG telecom/98-07-01 (Joint Telecom Log Service Initial Submission); Expersoft, Hewlett-Packard, Nortel, Telefonica, I+D

4.2.3.1 Geospatial and Imagery Access Services (GIAS)

Description: The Geospatial and Imagery Access Services (GIAS) specification defines the core interfaces of the United States Imagery and Geospatial Information System (USIGS) libraries for client access to geospatial information. USIGS has a common information management framework that enables sharing of data, services, and resources among IGC members and their consumers. The GIAS provides client access, which includes search, discovery, browsing, and retrieval of information and its associated meta-data. Geospatial information is defined to include imagery and imagery-based information, maps, charts and any other data that has a well-defined association with a point or area on the Earth.

The GIAS specification defines, through the use of OMG IDL, the interfaces, data types and error conditions that represent a geospatial information library. A GIAS-based geospatial library has interfaces that allow a client to search and discover information (data sets/products) contained in the library, inquire about details of a particular data set/product and arrange for the delivery of the data set/product to another location or to another system. Also provided are interfaces to allow a client to nominate information to be included in the library. There are also interfaces to allow library-to-library interchange of information as well as interfaces that support management and control of the client-library interactions.

USIGS Status: Mandatory

Usage: The definitions and semantics associated with the elements of the GIAS specification are intended to be as general and as broadly useful as possible. It is not intended to be a description of any single implementation or system but is intended to allow great latitude in the design and implementation

schemes for geospatial libraries. However, to ensure interoperability, all systems that must interoperate must make the same interpretations concerning this general specification. A *profile* of the GIAS specification for the intended community of use is a critical supplement to the GIAS specification itself. A profile is a formal documentation of the specific interpretations, limits, and conventions chosen by the community of use. The USIGS community will be producing profiles of the GIAS specification that document these factors.

4.2.3.2 Open GIS Simple Feature

Description: The purpose of this specification is to provide interfaces to allow GIS software engineers to develop applications that expose functionality required to access and manipulate geospatial information comprising features with 'simple' geometry using OMG's CORBA technology. It is envisaged that this specification will become a candidate for inclusion in the OMG's work as a vertical CORBAfacility covering geospatial information management.

In the design of this specification, the approach has been to use, where possible, existing CORBAspecifications to allow leveraging of the past and present efforts of OMG and vendors of other CORBA compliant products and specifications. Where it has been deemed inappropriate, alternative specifications have been developed that follow as closely as possible existing CORBA specifications.

USIGS Status: Emerging

Usage: The specification is broad enough to allow maximal flexibility in implementation. In particular, it has been designed with two implementation models in mind:

- The exposure of existing (legacy) geospatial data and applications whether they be RDBMS or proprietary file repositories through some form of object 'wrapping'.
- The development of new distributed object-oriented GIS applications.

This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time.

4.2.3.3 Geospatial and Imagery eXploitation Services (GIXS)

Description: The GIXS is an emerging suite of standard interfaces to geospatial exploitation services. These services can be broadly described as those currently provided by GOTS software packages such as JMTK, RULER, and FPE. Functional areas include image processing/exploitation (e.g. mosaicing and registration), mensuration and geopositioning, and geospatial analysis (e.g. line-of-sight analysis, terrain masking, and mobility analysis). The intent is to broaden this suite of APIs to address access to other geospatial services that are not currently offered by commercial software packages.

USIGS Status: Emerging

Usage: While the GIXS is still emerging, its use for access to geospatial services is strongly encouraged. The GIXS will serve as a migration path from the current interfaces associated with JMTK,

RULER, and FPE. The USIGS Interoperability Profile (UIP) Working Group is working to mature the GIXS in coordination with on-going USIGS development programs. Contractor/developer participation in this maturation process ensures a viable interface that meets the needs of the IGC. A *profile* of the GIXS specification for the intended community of use is a critical supplement to the GIXS specification itself. A profile is a formal documentation of the specific interpretations, limits, and conventions chosen by the community of use. The USIGS community (facilitated by the UIP Working Group) will be producing profiles of the GIXS specification that document these factors.

4.2.3.4 Common Business Objects

Description: Common Business Objects (CBOs) represent the obvious objects and relationships in the end user view of a distributed system. End users are the people that directly interact with the system. The Task and Session Model, which is the first CBO specification, does the following:

- Defines common objects for people, using (with some specialization) separately defined models; e.g., organization models
- Specifies common place objects that contain distributed and heterogeneous resources
- Defines objects that represent atomic units of work used by synchronization rules for managing parallel activity and resource sharing
- Defines a common user model with people, places, resources, and processes

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.5 Workflow Management Facility

Description: The Workflow Management Facility defines interfaces and their semantics required to manipulate and execute interoperable workflow objects and their metadata. The Workflow Management Facility will serve as a high-level integrating platform for building flexible workflow management applications incorporating objects and existing applications. This solicits proposals for the Workflow Management Facility.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.6 PDM Enabler

Description: PDM Enabler interfaces establish standards for the services provided by Product Data Management (PDM) systems. These interfaces made available through ORBs provide the standard needed to support a distributed product data management environment as well as providing standard interfaces to differing PDM systems.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.7 Calendar Facility

Description: The CORBA Calendar Facility that will allow applications to incorporate calendar services. Users should be able to manage calendars by adding, updating, and deleting calendar items; users should be able to perform queries on calendars; and users should be able to maintain metadata such as rules and alarms. Users should also be able to coordinate between many calendars.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.8 Electronic Payment Facility

Description: The Electronic Payment facility interfaces are an Object Framework that supports the implementation of industry standardized electronic payment protocols in an OMA-compliant system and specifications for one or more industries payment protocols.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.9 Negotiation Facility

Description: The Negotiation Facility enables multiparticipant negotiation and an object framework supporting dynamic negotiation rule substitution, rule verification, and interfaces through which domain policy can be used to control the disclosure of information and the decisions taken during the course of negotiation.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.10 Currency Facility

Description: Currency Facility supports the definition and management of currencies. This is distinct from “money,” which is an amount of one or more currencies. This facility will address currency representation, currency validation, and money algebra.

This document contains the specification of a set of business objects and related abstractions that support international currency as defined in the OMG's Currency Request for Proposal (OMG Document: finance/96-09-04). The specification describes the objectives and business requirements for each object or component. It then presents the complete specification and reviews compliance to the stated requirements.

The business abstractions defined in the specification include:

- a currency component
- basic business objects for currency, money, and exchange rate

  calculation and formatting mechanisms for the use of money

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.11 Party Management Facility

Description:

This RFP solicits proposals for specifications for the common features of a Party Management Facility for the Financial Service Industry. These facilities are part of systems that are commonly known as Client or Customer Information Systems.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.12 Person Identification Service

Description: The Person Identification Service (PIDS) functionality is under severe demands for integration with other clinical and financial information systems, *but it must integrate with these systems without coupling with them*. These paragraphs delineate the scope of the PIDS specification by explicitly identifying those problems that are addressed by the PIDS. The PIDS addresses the following specific problems.

Identification

The PIDS directly supports the identification of people currently receiving care in a specific venue and ID Domain, and will support identification in the face of highly incomplete identifying information.

ID Correlation

The PIDS supports both manual and automated correlation of IDs and records associated with health care consumers that have received care in different settings, and will address the problems of correlating IDs among the ID Domains of highly autonomous and frequently-reorganizing entities.

Patient Confidentiality

While the PIDS itself is not required to enforce confidentiality, its interfaces are delineated so that "request interceptors" (implemented by CORBA Security Services or otherwise) can enforce *any policy* that is defined in terms of:

- the user's identity
- the person identity that is the target of the information request
- the ID Domain(s) involved, and
- the person traits requested.

Thus it will become reasonable to expect and demand that PIDS implementations compete on the basis of their abilities to enforce complex or individualized confidentiality policy and to protect person information from inferential analysis.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.13 Lexicon Query Service

Description: The focus of the Lexicon Query Service specification is to define a set of common, read-only methods for accessing the content of medical terminology systems. What constitutes a medical terminology system can vary widely, from a simple list consisting of a set of codes and phrases at one extreme, to a dynamic, multi-hierarchy classification and categorization scheme at the other. The focus was on determining what could be construed to be "common" elements of terminology systems. "Common" in this case means the set of elements in which the semantics are fairly widely accepted, even though they may not be present in all or even many of the terminology systems available today. Our goal was to produce a specification that could be used to implement a reasonable and useful interface to any of the major medical coding schemes.

A key goal of this specification is to provide a single, agreed-upon way to ask a given question of a terminology system. Terminology systems may vary radically in their forms of representation and access. For example, the question "Is penicillin an antibiotic?" could be presented to one system in the form "Does there exist a subtype relationship in which the concept code for antibiotic is the supertype and the concept code for penicillin is the subtype?" In another system, the question may be presented as "Is there a record in the drug database whose key is 'penicillin' that has the value of 'Yes' in the antibiotic column?" The intention of this specification is to provide only one specific interface that may

be used to answer any given question, regardless of the underlying implementation. While this may increase the complexity of some implementations, we believe that this approach will greatly simplify the process of writing terminology clients.

The primary guide in the formulation of this specification was the set of requirements specified in the Lexicon Query Service RFP. The RFP was deliberately limited to requesting read-only services, in the belief that read access was the most immediate, feasible, and pressing need. In the specification there is further subdivision of read-only services into two categories:

- **High volume on-line services.** These services are used by an on-line production system. The services include translation, inference, presentation, and the like.

- **Perusal and browsing services.** These services are used occasionally as a means of understanding the content and structure of the specific terminology.

The primary focus of this specification is the first category of services, the high volume on-line type of service. It was believed that the immediate needs rested within that specific area, and that was the area that contained the most commonality and was the best understood. Perusal and browsing services were addressed only as necessary to satisfy specific RFP requirements.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.14 Clinical Observations Facility

Description: Examples of clinical observations include the following: laboratory results, vital signs, subjective and objective observations and assessments, observations and measurements provided by a specialist who interprets images and other multi-media data. Interoperable specifications that support the activities involved in accessing clinical observations are sought. The specifications should leverage existing standards such as HL7 and DICOM.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.15 Healthcare Resource Access Controls Facility

Description: This solicits proposals for resource access control facilities based on the CORBA Security service. Such a facility will provide a uniform way for application systems to enforce resource-oriented access control policies in the healthcare domain.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.16 Healthcare Data Interpretation Facility

Description: This solicits proposals for a Healthcare Data Interpretation Facility (HDIF) that will provide a general-purpose infrastructure capable of the following:

- accommodate a variety of intelligent transforms for clinical data
- enable easy integration of so-called intelligent systems into existing healthcare information systems
- provide common interfaces for performing intelligent transforms on healthcare data distributed across disparate healthcare data domains.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.17 Notification Service

Description: This solicits proposals for a service which extends the capabilities of the OMG Event Service to support filtering capability, a service which satisfies scalability demands of event-driven applications running within large, distributed, heterogeneous networks, a service which satisfies event management demands of distributed systems, network, and telecommunications management applications, and a specification of notification types and contents applicable to particular vertical domains.

USIGS Status: Emerging

Usage:

This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

4.2.3.18 Telecom Log Service

Description: The purpose is to solicit proposals for a CORBA-based Log Service that is similar to that provided by Log Control Function (LCF). This Log Service, in addition to support CORBA objects in a pure CORBA environment, is to be used by TMN systems via gateway function as well.

USIGS Status: Emerging

Usage: This specification has not been specifically profiled for use in USIGS. Therefore, the specification has not been mandated at this time. Use of this specification is encouraged, however.

This Page Intentionally Left Blank

5. Conventions and Guidelines

Section 5.1 presents USIGS conventions, and Section 5.2 presents USIGS guidelines.

5.1 USIGS Conventions

Interoperability cannot be achieved by the implementation of standards alone. It is necessary to augment the selected standards profile with USIGS-wide conventions for processes and procedures. A convention is a non-standardized but binding specification of practices typically used to maximize interoperability. This subsection defines an initial set of conventions for the USIGS. Candidate conventions are also discussed in this section. Conventions will continue to evolve as the USIGS is implemented. The conventions currently identified and discussed in this section are:

- *Naming Conventions for Directory and File Names*
- *Product Specifications and Standards*
- *NITFS Bandwidth Compression Standards and Guidelines Document*
- *USIGS Conceptual Data Model*
- *Mapping, Charting and Geodesy Accuracy*
- *Datums, Ellipsoids, Grids and Projections*
- *Core Video Metadata Profile*

5.1.1 Naming Conventions for Directory and File Names

Conventions for directory and file naming are stipulated in the DII COE Integration and Run Time Specification (I&RTS) [I&RTS97]. The I&RTS describes the COE approach for a standardized disk directory structure for application software developed and implemented to comply with the segmentation guidelines of the I&RTS. The disk directory layout and file naming conventions are described in I&RTS Section 5.2. Additionally, the I&RTS also contains data store/file standards and guidance for physical storage of databases and data objects in Section 4.3.

5.1.2 Product Specifications and Standards

Appendix C of the UTA presents a list of NIMA product specifications and standards that document the format and content of NIMA generated products. These product specifications represent current methods and guidelines for developing MCG&I products that are primarily used with legacy systems. Any USIGS system that intends to produce a product contained on this list must meet the requirements specified in the product specification or standard for that product.

5.1.3 NITFS Bandwidth Compression Standards and Guidelines Document

This document (N-0106-97), dated 25 August 1998, defines the bandwidth compression standards, conventions and guidelines required for use by the National Imagery Transmission Format Standard (NITFS). It includes specifications on those standards, and implementation-related conventions and guidelines to improve interoperability of NITFS compressed files within the USIGS. The standards, conventions and guidelines defined in this document apply to the planning, development, test, evaluation and operation of imagery and geospatial systems that generate ("pack") or receive ("unpack") NITFS files within the USIGS environment. The use of this document is mandatory within the USIGS when the NITFS is being utilized.

Section 5 of this document defines Downsample JPEG Compression (NIMA Method 4). This approach provides a means to use existing lossy JPEG capabilities in the field to get increased compression for use with low bandwidth communications channels. NIMA Method 4 specifically correlates to a selection option (Q3) within downsample JPEG that provides a very usable tradeoff between file compression and the resulting loss in quality. Section 6 of the document outlines general requirements for NITFS compression.

A copy of this document can be found at: http://www.ismc.nima.mil.

5.1.4 USIGS Conceptual Data Model

The USIGS community relies heavily on the ability to exchange quality, seamlessly integrated, MCG&I information. The USIGS Conceptual Data Model (USIGS/CDM) facilitates this interoperability. The USIGS/CDM documents the data structures, meanings, and relationships for information requirements within the Imagery & Geospatial Community. It is the top layer of the three composing the model architecture; the other two being the Logical and Physical. The USIGS/CDM represents a high-level, precise, and unambiguous representation of MCG&I data and provides names, definitions, and structures for the conceptual elements within each functional area. The USIGS/CDM is composed of nine volumes comprising data models, relationships, entities, attributes, definitions, domains and other characteristics of data. The volumes are:

- Vol. 1: Overview - addresses the USIGS/CDM structure, background. Aids in understanding of remaining (8) volumes
- Vol. 2: Metadata - contains the integrated metadata model views and information about production, maintenance, and storage of datasets
- Vol. 3: Imagery - contains model views that describe images, sensor/capture capture information, and imagery targets
- Vol. 4: Air Transportation - contains model views for the air transportation of people and cargo
- Vol. 5: Ground Transportation - contains model views associated with fixed cultural features on the earth’s surface which support the ground transportation of people and cargo
- Vol. 6: Water Transportation - contains model views associated with navigation over water surfaces

- Vol. 7: Water Features - contains model views associated with stable water features inland of the coastline
- Vol. 8: Cultural Features - contains the model views associated with man-made features not supporting transportation.
- Vol. 9: Physiography - contains model views associated with rock formations, snow, ice, surface minerals, and vegetation.

The DoD Directive 8320.1 directs DoD agencies to standardize data elements and established the Defense Data Dictionary System (DDDS). Data element submission and acceptance to the DDDS requires that the candidates be modeled. Many of the models and definitions in the USIGS/CDM are already in the Defense Data Dictionary Systems (DDDS) as approved standard data or in the review process leading to approval. The current DDDS status of each data entity and attribute is noted within the USIGS/CDM.

The use of the USIGS/CDM is mandatory within the USIGS in order to ensure effective and secure use of USIGS MCG&I information resources. Revision A, dated 23 June 1998, of the USIGS/CDM was released to support USIGS Effectivity 1.5. The USIGS modeling effort is a continual process and is dynamic; therefore expect the USIGS/CDM to be modified and re-released to support ongoing USIGS development programs.

The latest status and project information can be found at: http://www.nima.mil/aig/.

The USIGS/CDM is available on CD-ROM from the Systems Engineering & Integration Division (SOS), Engineering Branch (SOSE).

5.1.5 Mapping, Charting and Geodesy Accuracy

Department of Defense Standard Practice: *Mapping, Charting & Geodesy Accuracy* (MIL-STD-600001), 26 February 1990, defines Mapping, Charting and Geodesy (MC&G) product accuracy and provides a common basis for the appropriate application of these definitions. This standard practice is the convention to be used within the USIGS for both internal and contractual development efforts and to all levels involved in the maintenance of USIGS supported MC&G products.

5.1.6 Datums, Ellipsoids, Grids and Projections

NIMA Technical Manual: *Datums, Ellipsoids, Grids, and Grid Reference Systems* (NIMA TM 8358.1) defines the various grids, ellipsoids and datums to be used in the production of MC&G products. This manual is the convention to be used within the USIGS in support of the production of these products.

NIMA Technical Manual: *The Universal Grids: Universal Transverse Mercator (UTM) and Universal Polar Stereographic (UPS)* (NIMA TM 8358.2) describes the Universal Transverse Mercator and Universal Polar Stereographic projection systems. This manual is the convention to be used within the USIGS in support of the production of MC&G products.

Military Standard (DRAFT): *Datums, Coordinates, and Grids for MC&G Applications* (MIL-STD-2405) is a draft standard, prepared by NIMA, and has not been approved. It is subject to modification

and therefore has not become an official NIMA or DoD standard. This considered to be an "emerging" convention and is not currently to be used for acquisition or other official purposes.

5.1.7 Core Video Metadata Profile

The Core Video Metadata Profile, Version 1.0, 14 March 1997, identifies a community-wide common set of video metadata that, when available, must be included in all Imagery & Geospatial Community (IGC) analog and digital video imagery signals. The near-term requirement to support current “analog video” in the IGC with a coordinated set of metadata was a significant factor in the selection of specific data elements in the profile. However, this profile also provides a stable foundation for metadata supporting digital video. As the IGC migrates from legacy analog applications to mostly digital video, the video metadata set will be modified to support data handling in the digital environment.

As part of the larger data standardization effort many of the elements correlate with data elements named and defined in the USIGS Conceptual Data Model (USIGS/CDM), Volume 3: Imagery. The Core Video Metadata Profile was designed to support current IGC needs including video archiving, exploitation, and dissemination; mapping and co-registration; and community-wide interoperability. Longer-term community requirements include the need for increased quality, accuracy, and additional video tools. Future requirements affecting the evolution of the Profile include the insertion of video into the entire IGC, expanding requirements to include tasking, collection, exploitation, reporting, product generation, and engineering studies and evaluations of video.

A copy of this specification can be found at: http://www.ismc.nima.mil.

5.2 USIGS Guidelines

USIGS Guidelines provide the final part of the framework to facilitate the successful implementation of the USIGS. Guidelines are not requirements for implementation, but rather constitute “recommended practices” among members of the USIGS community. Whenever possible, USIGS Guidelines will be aligned with the guidelines from larger communities, to which the USIGS belongs. The guidelines currently identified and discussed in this section are:

- *Guidelines for Server Names*
- *Image Quality Guidelines*

5.2.1 Guidelines for Server Names

Server names within the USIGS must be easily identifiable and accessible. Therefore, the names of servers are recommended to be in the form:

server type.site id.network id.domain name

server type is a recognized server type within the USIGS. As the USIGS architecture evolves, additional servers will be specified. Examples include the Image Product Libraries (IPLs), the Command Information Libraries (CILs), and the National Information Library (NIL). The convention should be

expanded to also include softcopy exploitation work group servers and others developed and implemented within USIGS.

site id is a an identifier that is unique to each site at which a USIGS server is deployed.

network-id is an identifier for a specific wide area, metropolitan area or local area network.

domain name is an organizational designation.

The *site id, network id,* and *domain name* conventions are centrally managed for sensitive compartmented information (SCI) networks. The process for assigning these identifiers are contained in the *Communications Systems Architecture for the INTELNET,* dated 22 April 1997, and identifiers are registered and assigned through the Network Information Center (InterNIC).

An example notation of the IPL at NIMA's Washington Navy Yard Building 213 could be represented as:

IPL.B213.nima.ic.gov

5.2.2 Image Quality Guidelines

As part of NIMA's Technology Forecast effort, the Systems and Technology Directorate's Technology Office (ST/T) is working to update the United States Imagery System (USIS) Standards and Guidelines: Image Quality Guidelines [USIS95, Appendix IV]. These "guidelines are presented as suggestions which will minimize quality losses in the processing and presentation processes." These guidelines address both softcopy and hardcopy image quality.

This Page Intentionally Left Blank

6. Standards Technology Forecast

This section describes and discusses a variety of emerging technologies expected to result in new standards that will have a significant effect on the USIGS. This section is not intended to be a comprehensive analysis of technology trends in general.

The first part of this section is a synopsis of the current NIMA technology forecast. This is followed by discussion of these technologies:

- Distributed Computing
- Activities at the OGC in Open GIS technology
- Collaborative Computing
- Security in a distributed multi-domain environment

Each of these will be discussed relative to their status at the time that this document was completed, expectations for the near future, and their specific effects on the USIGS.

6.1 Synopsis of NIMA Imagery and Geospatial Technology Forecast

The current NIMA technology forecast, published in June 1997, is called "R&D Strategic Thrusts: FY96 Imagery & Geospatial Technology Baseline" [NIMA97]. The forecast is organized around four functional areas that are central to NIMA and USIGS:

1. Exploitation and analysis technologies
2. Information and data handling
3. Implementation tools and methodologies
4. Collection technologies

For each of these areas, a forecast is presented in three time frames: until 2002, 2002-2008, and 2009-2014. Tables 6-1 through 6-3 show the forecast through 2002.

Table 6-1. Exploitation and Analysis Technology Matrix

Technology Sub-Area	By Target 1 (2002)
Automated Image Examination	Limited ATD/ATC on workstations Automated 3-D wireframes Limited 4-D video exploitation
Softcopy Exploitation	Digital capability Integrated video exploitation Historical, comparative & predictive decision support tools
Data Fusion and Analysis	Manual/semiautomated visual fusion

Technology Sub-Area	By Target 1 (2002)
Information Visualization	Fly-through capability (Virtual Reality display)
Spectral Phenomenology	Limited Spectral understanding and application
Image Display and Reconstruction	Advanced 2-D/aided 3-D displays
Multimedia Products	Semi-automated product generation
Collaborative Exploitation and Analysis	Peer-to-peer and team collaboration

Table 6-2. Information & Data Handling Technology Matrix

Technology Sub-Area	By Target 1 (2002)
Integrated Imagery/Geospatial System Management	Multiple (2+) management systems Integrated softcopy exploitation management Automated multiple objective/multiple system collection nomination Network-based imagery/geospatial product dissemination for EAC (echelons above Corps) tactical users Smart compression techniques for product dissemination Customized sensor-to-shooter packages
Mass Storage and Management	Operational 3-dimensional storage technologies Ruggedized high capacity storage systems (~petabyte) Context-sensitive archiving State-of-the-art optical disk storage Partial regional imagery and geospatial product archives
Information Management, Discovery, and Retrieval	Context-based search and retrieval Text and limited imagery/geospatial data NIDR Intelligent SW agents Limited-domain BOK for imagery/geospatial and collateral data
Communications Equipment and Networks	High Capacity Fiber data connectivity > 2.5 Gbps in major world population centers High capacity mobile (radio/VSAT/direct broadcast) to deployed units at 10-45 Mbps Implementation of imagery/geospatial-capable LANs (> 150 Mbps) Initial implementation of network–based imagery and geospatial product dissemination system, including tactical users

Technology Sub-Area	By Target 1 (2002)
Communications Security	Dedicated, system-high networks Prototype operational MLS systems Advanced firewall technologies High-capacity (>625 Mbps) key-agile encryption schema Use of session encryption software for time-sensitive data
Data Compression and Decompression	Wide application of state-of-the-art commercial compression techniques to literal/SAR imagery, video, voice and geospatial data Imagery/geospatial data compression ASICs Compression supporting successive refinement of imagery/geospatial data
Computer Hardware and Software	Latency-tolerant, distributed operating systems Object-oriented or transaction-based operation Low-latency parallel architectures (>100 GFLOPS throughput) Prototype optical computing in selected applications Advanced 2-D graphical user interfaces User-tailorable SW algorithms

Table 6-3. Implementation Tools and Methodology Technology Matrix

Technology Sub-Area	By Target 1 (2002)
Software Engineering Tools	Advanced Computer Aided Software Engineering (CASE) Tools providing platform independent programming Transparent applications with CORBA compliance Integrated testing environments Fuzzy logic programming Distributed, collaborative engineering environments
Simulation Tools and Methodologies	Development of a high-fidelity model of the exploitation process Analytical simulation tools for imagery/geospatial development and acquisition Protocols and open architecture standards for distributed interactive simulation and interoperability Use of modeling and simulation to support requirements and procedures development Scaleable simulations

Technology Sub-Area	By Target 1 (2002)
Training Tools and Methodologies	Incorporation of advanced learning technologies
	Fully embedded training systems
	Context sensitive/adaptive training
	Integration of imagery/geospatial products into user training systems
	Virtual reality training environments at the operator level

6.2 Distributed Computing

At the time of this writing there existed four predominant technologies for implementing distributed computing, one of which is oriented toward procedural distributed computing (but which supports distributed object computing (DOC)) and three that are oriented toward DOC. All are discussed in the following paragraphs.

6.2.1 Distributed Procedural Computing

Distributed procedural computing is predominantly accomplished using the Open Group-defined Distributed Computing Environment (DCE). It is important in the context of this discussion because DCE services are often used with an object-oriented "wrapper" as a quick way to provide CORBA services. In particular the Domain Name Service (DNS) and the Security Service (based on Kerberos) are often used by CORBA vendors to provide a quick solution, while taking more time to develop "pure CORBA" implementations. The DCE Transaction Service is also sometimes used in CORBA service implementations.

Also important to note is that the Microsoft Distributed Common Object Model (DCOM) protocol (see 6.2.2.1 below) is based on the DCE Remote Procedure Call (RPC) and that this same RPC is an allowable, but not recommended, wire protocol in CORBA implementations.

6.2.2 Distributed Object Computing (DOC)

6.2.2.1 Microsoft COM+

Microsoft ActiveX contains within it a wire protocol for distributed computing known as the Distributed Component Object Model (DCOM). This particular protocol is an extension of the DCE RFC that is intended to allow for distributed computing using the Common Object Model (COM) supported by Microsoft. This particular protocol is quite acceptable for a small closed-environment distributed computing capability, but has several serious liabilities when used in a Wide Area Network (WAN), particularly with respect to security. Thus, beyond limited use in a workgroup environment, it is not particularly suited to use within the USIGS. (NOTE: This does not mean that other elements of ActiveX should not be used.)

It is known, however, that Microsoft is working on a replacement for the DCOM that is expected to be available for use in 1999. It is too early, however, to speculate on its form and functions.

With respect to the DCOM effect on the standards environment, a specification for DCOM was submitted by Microsoft as an informational Request for Comment (RFC) to the Internet Engineering Task Force (IETF) in 1996. This type of RFC has a six-month lifetime, after which it is no longer available as an IETF document. Microsoft has allowed the RFC to expire and had not superseded it with any other specification by the time of this writing.

6.2.2.2 OMG Common Object Request Broker Architecture (CORBA)

The Object Management Group (OMG), a consortium of nearly 800 members (including Microsoft and Sun), has been developing the specifications for CORBA and its environment since 1989. The OMG has recently been approved as a Publicly Available Specification (PAS) submitter by the International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) Joint Technical Committee 1 (JTC1). This allows the OMG to submit specifications directly to JTC1 and its subcommittees, without going through any national body and without being edited by any subcommittee or working group of the JTC1. By being submitted as a PAS, a specification will take on a status equivalent to a Draft International Standard (DIS) and may be balloted by any JTC1 subcommittee. If such a specification completes balloting successfully, it will become an International Standard (IS).

The OMG is considering its options, but it appears that the first OMG specification to be submitted to the JTC1 will be the subset of the CORBA version 2.1 specification (OMG document formal/97-09-01: CORBA/IIOP 2.1 Specification) [CORBA97d] that defines the Internet Inter-Orb Protocol (IIOP). IIOP is the protocol that allows Object Request Brokers (ORBs) to interoperate.

IIOP was initially designed to provide interoperability between ORBs by passing object references between the ORBs. This enabled a client application to invoke objects on a server rather than on the client. The IIOP specification is being augmented with a “pass-by-value” capability that will allow for the transfer of objects between ORBs, alleviating several problems including easing the communications load associated with the transfer of collections of fine-grained objects. It is also expected that client-side garbage collection will be added to the IIOP specification in 1998. Other refinements can be expected over time, but it is unlikely that there will be other revisions in the near future.

A subset of the CORBA version 2.0 specification [CORBA97a] has already reached the IS status, the Interface Definition Language (IDL). In ISO, it is known as the Reference Model for Open Distributed Processing (RM-ODP) IDL (ISO/IEC IS 14750). RM-ODP IDL is syntactically and semantically identical to CORBA IDL, although the documents themselves differ slightly.

OMG also has a number of Task Forces addressing specific information domains including electronic commerce, finance, manufacturing, medicine, telecommunications, and others. These Task Forces will adopt domain specific specifications for the CORBA environment.

6.2.2.3 Remote Method Invocation (RMI)

The third prominent distributed object capability is the Java Remote Method Invocation (RMI). The Sun Microsystems JavaSoft Division has defined the JavaSoft-proprietary RMI wire protocol to enable the interoperability between Java objects (applets). This protocol is meant for Java-to-Java interoperability only and is both more and less than CORBA IIOP. It is more than IIOP in that it includes client-side

garbage collection. It is less than IIOP, because it lacks some of the functionality of IIOP and does not support languages other than Java. JavaSoft has stated an intention to continue the development of RMI to provide functionality found in IIOP and not in RMI, while OMG will be enhancing IIOP to include client-side garbage collection. JavaSoft will then include both in the Java Development Kit (JDK), with RMI to be used for Java-to-Java interoperability and IIOP to be used for Java-to-everything-else interoperability.

6.3 Open GIS Consortium Activities

A Geospatial Object Model is being developed by members of the Open GIS Consortium (OGC) who are from both the user and vendor community, in conjunction with developers of the USIGS architecture. The model, which will be documented in a technical report, is focused on services that maintain, provide access, manipulate and exploit MCG&I data (e.g., imagery and feature data). This modeling effort provides a forum where parties involved in developing portions of the USIGS Architecture can discuss and collaborate on what software components are needed to support various functions of USIGS. The model being created is not attempting to provide implementation level detail. That is left to profiles being developed under the auspices of the UIP effort. The object model should be considered as guidance only at this time and for the foreseeable future.

The object model has been constructed with the goal of facilitating collaboration among the various NIMA Development Programs. Collaboration has been done with different groups implementing portions of the USIGS System Architecture. Various ongoing implementation efforts are developing a set of specifications with component interfaces defined in the Interface Definition Language (IDL). These efforts are producing object models to serve as guidance in generating the IDL. Portions of these various groups' object models have been examined and adopted as appropriate for this effort. The two that have been examined to date are the Geospatial and Imagery Access Services (GIAS) and the Geospatial and Imagery eXploitation Services (GIXS). The GIAS is being developed for the NIMA Libraries Program, while the GIXS is being developed for various groups of the NIMA Exploitation Tools Division. These object models are being harmonized with the model being generated as part of this effort.

Another major effort to be undertaken, but not yet initiated, is the harmonization of this modeling work with the development of the Conceptual Data Model being defined as part of the USIGS architecture.

Table 6-4 shows services that will be available for various UTA components by the end of 1999, and the specifications that are being developed by OGC or OMG. Table 6-5 shows other services that will be available in 2000 or later.

Table 6-4. Technical Architecture Services Available by the End of 1999

Applicable UTA Component	Applicable Specification	Status	Responsible Organization(s)	Comments
Shared Domain Components - Telecommunications Domain	Telcom Log Service	RFP has been released.	OMG	Adoption of this technology is expected in 1999.
Geospatial Domain Access Services	Gridded Coverages	RFP released	OGC	Adoption of this technology is expected in 1999.
Geospatial Coordinate Transformation Services	Geospatial Coordinate Transformation Services		OGC	OGC is in the process of developing a technology RFP.
Imagery Manipulation Services	Gridded Coverages	RFP released	OGC	Adoption of this technology is expected in 1999.
Imagery Manipulation Services			OGC	OGC is developing an abstract specification for geospatial and imagery portrayal services.
Imagery Exploitation Services			OGC	OGC is in the process of developing an abstract specification for Mensuration Services.
Geospatial Display Services			OGC	OGC is in the process of developing an abstract specification for this service.
Interoperable Name Service		Initial submissions received	OMG	Expected to replace the Naming Service in 1998 or 1999
Compound Presentation and Interchange Facility	CORBA Component Model	Pre-Initial submissions received	OMG	This facility is often referred to as "CORBA Beans."
Calendar Facility	Calendar Facility	RFP issued	OMG	Adoption of technology is expected in 1999.
Shared Domain Components -- Financial Domain	General Ledger Facility	RFP has been released.	OMG	Adoption of this technology is expected in 1999.
Geospatial Information Dissemination Services	Stream-based Model Interchange	RFP Released	OMG	
Tagged Data Facility	Tagged Data Facility	RFP Released	OMG	
Common Business Object Facility		RFI Issued	OMG	
Shared Domain Components -- Electronic Commerce Domain	Negotiation Facility	RFP has been released	OMG	

Table 6-5. Technical Architecture Services Available in 2000 or Later

Applicable UTA Component	Applicable Specification	Status	Responsible Organization(s)	Comments
Geospatial Annotation Services				
Geospatial Feature Analysis Services			OGC	
Feature Generalization Services			OGC	
Image Map Generation Services			OGC	
Image Synthesis Services			OGC	
Image Geometry Model Services			OGC	
Geospatial Information Extraction Services			OGC	
Geospatial Symbol Management Services			OGC	
Image Understanding Services			OGC	
Data Interchange Facility				
Imagery Compression Facility				
Information Storage and Retrieval Facility				
Internationalization and Time Operations Facility				
Mobile Agents Facility				
Rendering Management Facility				
Security Administration Facility				
Shared Domain Components -- Electronic Commerce Domain	Asset and Content Management	RFI has been issued	OMG	
Shared Domain Components -- Electronic Commerce Domain	Electronic Commerce Enabling Technologies and Services	RFI has been issued	OMG	

6.4 Collaborative Computing

Collaborative computing is typified by the capability of one or more individuals and/or applications programs to share information in a timely manner. This section discusses these aspects of collaborative computing:

- Introductory description of the technology
- Geospatial requirements for this technology
- Standards that currently exist
- Available products that conform to the standards
- Status and future directions

6.4.1 Description

Examples of collaborative computing include the following:

- Simple file sharing (FTP, file sharing, etc.)
- Electronic mail (e-mail)
- Concurrent editing (e.g., shared whiteboard)
- Desktop audio teleconferencing
- Desktop video teleconferencing
- Data conferencing

Today, in a client/server environment, most collaborative computing takes place through the sharing of textual or formatted data that is exchanged via a file, database, or electronic mail server. Only occasionally does the information being shared take the form of image, graphic, audio, or video formatted data. This does not, for the most part, occur in real-time or anywhere near it, although some networks provide the capability for individuals to converse using text messages.

Elements of Internet and Java are now being incorporated into collaborative computing. The technology is reaching the point where it allows sharing information of all data types. The technology is emerging that will economically provide users on a network the ability to sit at their workstations and communicate via video and audio in real-time. In effect, a group of users will be able to create a virtual conference room, with the ability to share all forms of communication and information on demand.

Data conferencing is a relatively new form of collaborative computing. It is also called audiographics. Forms of data conferencing include shared whiteboard, document conferencing, and application sharing. Like other forms of teleconferencing, data conferencing is characterized by real-time communications, which differentiates it from “over-time conferencing” such as e-mail, newsgroups, and Lotus Notes.

6.4.2 MCG&I Requirements

Exploitation and Analysis is a key USIGS function that will make use of collaborative computing. Collaborative Exploitation and Analysis includes the sharing or the assisted performance of MCG&I exploitation/analysis tasks in two basic modes:

- Within peer group: Collaboration among a dynamically-defined analytical peer group, distributed organizationally and geographically
- Across functions: Collaboration in support of the collection/analysis tasking, data management, analysis refinement, information generation, and end-user feedback.

Collaborative exploitation and analysis includes workgroup-capable analysis, documentation applications, collaborative workspaces, intelligent agents to mediate, shared digital light tables, virtually-shared whiteboards, and collaborative planning/editing/production tools.

The vision for collaborative exploitation and analysis within the imagery & geospatial community includes these elements:

- A worldwide network of MCG&I data repositories that enable the sharing of MCG&I data and metadata across the community
- Worldwide, dynamically-formed workgroups of analysts, providers and consumers to address time-sensitive issues
- Cooperation of individual MCG&I analysts on joint exploitation tasks in real-time
- Access to MCG&I expertise
- Near real-time cooperation between analysts and end users for update
- The use of intelligent agents capable of browsing the MCG&I network and repositories for metadata information to support particular exploitation/analysis tasks (“pull”)
- Automated, adaptive user profiling for data mining (“push”) for the analysts
- The use of advanced visualization tools to achieve a “ubiquitous computing” environment.

6.4.3 Standardization

There are two main families of standards supporting collaborative computing: H.320 and T.120. H.320 is a family of video conferencing standards adopted by the ITU-T (the International Telecommunications Union Telecommunication Standardization Sector) that run over a variety of communications lines (T1, F-T1, ISDN BRI or PRI, Switched 56). The H.320 standards describe the frame structure and terminal procedures for multimedia communication multiplexed over one or more digital channels.

T.120 is a newer family of standardized communications and application protocols that provide support for real-time, multi-point data communications. It supports many kinds of multimedia data: images with real-time annotation, application sharing, and file transfer. These multi-point facilities are the building blocks for a new range of collaborative applications.

The DoD JTA, Version 2 [JTA98], has this discussion of emerging Video Teleconferencing (VTC) standards:

> Federal Telecommunications Recommendation (FTR) 1080-1997 will be updated by a revision to its Appendix A. The updated document will include multimedia applications such as shared whiteboard and still-image annotation, and additional security specifications. ITU-T H.321 and ITU-T H.323 are two emerging recommendations that support VTC over ATM and Ethernet networks, respectively. Also, ITU-T H.310, Broadband Audiovisual Communication Systems and Terminals, ratified November 1996, is an umbrella standard for VTC over high-bandwidth (ATM) communication links. H.310 includes underlying standards for video (MPEG2), and audio (MPEG1, MPEG2). H.310 is used for high-quality VTC requiring > 2 Mbits/s infrastructure. In the T.120 series of multimedia standards, T.128, Application Sharing, is a draft standard pending approval.

6.4.4 Products

Many products and tools exist for audio conferencing; shared whiteboard, video conferencing, and session management. For example, Compression Labs Inc., PictureTel, VTEL, British Telecom, Tandberg, Hitachi, Panasonic, and Mitsubishi all provide products that are H.320 standards-compliant. The T.120 standard is implemented in products from DataBeam, PictureTel, VTEL, British Telecom, Intel, Apple, Polycom, Vivo, Sony, Sun microsystems, GPT Video, Microsoft, and many more. The T.120 market leaders are PictureTel (Live PCS 50 and PCS 100) and Intel (ProShare Video System 200).

6.4.5 Status and Directions

A combination of audio-, video-, and data-conferencing is a feasible alternative today, in terms of cost, quality, and effectiveness. The technology does not yet provide an ideal solution in any of these areas, but it provides an adequate one. There are still a number of deficiencies to be noted:

- Scalability of virtual workplace tools to very large, distributed information environments remains an open question, both from time responsiveness and avoidance of overload
- More work is needed in integration of tools, to move from tool to tool and combine the analysis results. Collaborative tools need to be integrated with search and retrieval tools.
- Adaptation and integration of collaboration technologies for use by MCG&I analysts are unproven within the community
- Audio and video conferencing tools provide limited interoperability
    - Limited support for standards-based codecs
    - Limited support for the same codecs across audio and video tools
    - Announcements for future support for T.126 (Still Image Exchange) from many vendors, but not here yet
- Some audio conferencing tools only support point-to-point conferencing between two people; awaiting third party MCUs for multipoint capability

One problem with interoperability is that even if vendors follow the standards, there is no assurance that solutions from different vendors will interoperate out-of-the-box. Some work is being done to address this issue. Building on the ITU open video-conferencing recommendations of the H.320 and T.120

families, the Versit H.320 Implementors' Agreement has been developed which interprets and clarifies the ITU H.320 Recommendation. Many companies reviewed and contributed to this agreement. The development of this agreement is an important step in achieving the interoperability that will enable the collaborative working environment.

Future directions

The general trend in collaborative computing may summarized as follows:

- Conferencing will be built into general applications
  - A combination of application sharing and distributed document/object technologies will be used
  - Applications will be conferencing aware and provide new features for group collaboration
- Standards will become increasingly important for application internetworking
- There will be smooth integration of synchronous and asynchronous messaging
- The use of LAN, telecom, and Internet will be transparent.

6.5 Security

The combination of a distributed object environment along with the variety of envisioned USIGS customer/user types introduces significant architectural challenges for USIGS security. The issues are being identified and documented in a separate study [Usec97], and therefore will not be delineated here.

Appendix A: MCG&I Domain Services

While the USIGS will invoke components that are defined for many information domains, the domain of greatest interest to USIGS planners, implementers, and users is, clearly, the MCG&I domain.

The MCG&I domain services architecture identifies the services required for the building of MCG&I applications. This appendix addresses the conceptual structure of the MCG&I domain services architecture and outlines the categories of services, and their interfaces, that are required to populate that architecture. The services have been grouped into service categories which, in some cases, are grouped into service categories of a broader nature. The service category groupings are based upon the anticipation that the services within each service category will:

- Have the same, or very similar, object signatures
- Operate on the same, or very similar, metadata
- Manipulate or use the same feature type (point, line, polyline, image, etc.)

In essence, the MCG&I domain services architecture provides a structure for ensuring that all of the appropriate objects and methods are defined. Implementation specifications, that serve to define the syntax and semantics of the services identified herein, may be structured differently in order to depict the processing interdependencies that exist across categories. Actual implementations are expected to differ as well, since all MCG&I applications will not use all MCG&I services, nor will they be restricted to MCG&I services and, therefore, may be grouped differently.

A.1 Consensus MCG&I Domain Architecture

The Open GIS Consortium, Inc. (OGC) (for more information on the OGC, please see their WWW page at http://www.opengis.org/) is in the process of defining an object-based architecture for geospatial services and structures. OGC's Open GIS Service Architecture has been designed in cooperation with the design of the USIGS MCG&I domain services architecture, so there are few significant differences between them. The following paragraphs discuss those service categories and services of that architecture.

Throughout this appendix, there are figures that show the USIGS MCG&I domain services and Open GIS Service Architecture components. The intent is to illustrate the cooperation and dialog that has been developed between NIMA and the OGC in aligning their architectures. At the time of this writing, this was an ongoing process, so both models are expected to progress with the highest possible level of commonality.

A.2 MCG&I Domain Service Categories

A.2.1 Geospatial Domain Access Services

Geospatial Domain Access Services (GDAS) defines a set of interfaces for locating and retrieving selected MCG&I information for storage, deletion, or modification. Geospatial Domain Access Services include:

- Geospatial Information Access Services
- Geospatial Dissemination Services
- Geospatial Information Packaging Services

Figure A-1 illustrates the USIGS technical architecture elements related to the GDAS.

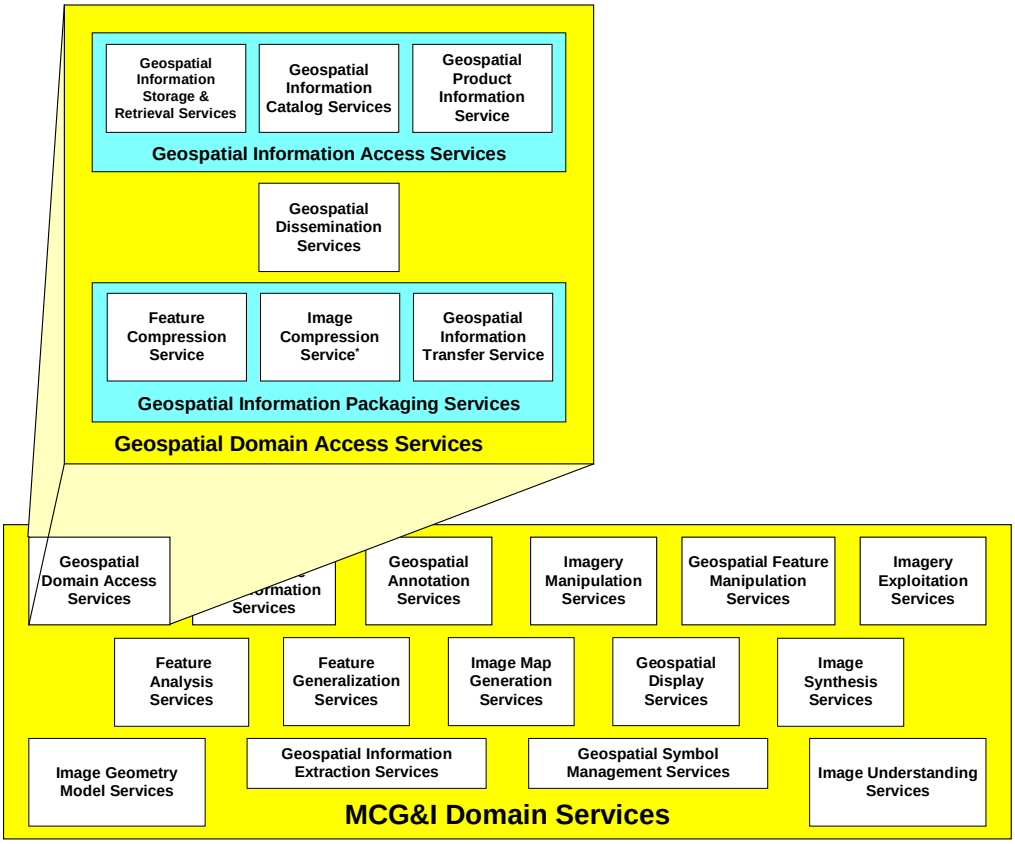


Figure A-1. USIGS Geospatial Domain Access Services

A.2.1.1 Geospatial Information Access Services

Geospatial Information Access Services comprise three specific service categories:

- Geospatial Information Storage and Retrieval Services
- Geospatial Information Catalog Services
- Geospatial Product Information Services

A.2.1.1.1 Geospatial Information Storage and Retrieval Services

Geospatial Information Retrieval Services provide services for MCG&I information storage and retrieval for the purposes of deletion, modification, and/or display. Geospatial Information Retrieval Services are intended primarily for client storage and retrieval of geospatially referenced information of all kinds to/from a library (data server) that may be remotely located relative to the client. The Geospatial Information Retrieval Services provide for the following basic capabilities:

- Retrieval of selected MCG&I information, including the capability to request dissemination to client and third-party clients (Thus, this operation supports a form of push-mode transfer through a third-party request.). The retrieval process must support retrieval of features (including images and gridded information) that are contained within a boundary defined by a rectangle or ellipse. Thus, retrieval of portions of one or more images must be supported.

- Storage of MCG&I information in a library

- Monitoring the status of submitted requests, for both storage and retrieval, and for canceling incomplete requests when desired.

- Conversion of retrieved data from the structure or format it in which it is stored in the library to a different structure or format that has been requested by a client, as in converting raster to vector, Vector Product Format (VPF) to Spatial Data Transfer Standard (SDTS), etc.

A.2.1.1.2 Geospatial Information Catalog Services

The Geospatial Information Catalog Services provide a set of common services to support both local and global MCG&I information discovery, property (metadata) retrieval, MCG&I information browsing, and MCG&I information cataloging and indexing. Types of retrieval that are required include:

- Ordinary catalog search queries by accepting Boolean query syntax expressions as input and returning a set of query hits matching the expression.

- Polygonal query capability enabling ordinary catalog search queries by supplementing Boolean queries with the specification of a polygonal shape. MCG&I information that overlaps any portion of the polygon should satisfy the query if the product properties also satisfy the Boolean query expression.

- Elliptical query capability enabling Boolean catalog search queries combined with the specification of an elliptical shape. The ellipse should be defined by its center point, major and minor axes, and the azimuth rotation from North of the major axis and returns geospatial information that provides coverage of any portion of the ellipse while satisfying the Boolean Query Syntax expression.

- Point query capability to supplement Boolean queries by specifying a geographic point. Image products returned by this query should combine the Boolean Query Syntax expression and coverage of the specified point.

- Get More Results capability to access invocations of the Geospatial Information Catalog Services operations that are unable to return entire sets of query hits in the allocated area for query results. A QueryId value is returned and used with the "get_more_results" operation to obtain the remaining query hits.

- Capability to inform the catalog server that the client does not intend to retrieve additional results from the list provided by the catalog, allowing the catalog server to free any resources allocated for the client's query results.

- Ability to add and remove catalog entries.

A.2.1.1.3 Geospatial Product Information Service

The Geospatial Product Information Service provides for the retrieval and storage of whole products (predefined feature collections and metadata subsets) and allows the client to retrieve some properties specifically associated with an object without going to the catalog. The Geospatial Product Information Service provides for robust references to arbitrary information products in a distributed environment through the use of library location information and file path names. Since the product reference is expected to contain all of the necessary information for retrieval, distributed processing can be handled transparently. The product references are specialized in the Geospatial Product Information Service for use by libraries and include support for parameters. This service is equivalent to having a paper map or preprinted image, in that the boundaries and content of the information are known before the information is requested. This capability is of particular use in the dissemination of reports and the like for which all recipients or requesters are not previously known. In an electronic environment, it provides the capability to predefine an MCG&I component of a web page, for instance.

A.2.1.2 Geospatial Dissemination Services

Geospatial Dissemination Services include the interfaces required to receive, prepare (i.e., reformat, compress, decompress, etc.), prioritize, and transmit MCG&I information that has been requested by a client through standing queries or profiles. They also include interfaces to support product distribution management and to enable dissemination of MCG&I information to third parties. This is strictly a batch-like capability that is expected to use the Geospatial Information Access Services and the Geospatial Information Packaging Services as components. Operationally, it is expected that this component would be invoked by a library resident event handler. Invocation would occur at the time a message containing new information is received by the library and processed for storage therein. At that

time, the Geospatial Dissemination Services would check its repository of standing queries for those that are satisfied by the new information, make appropriate modifications to the information's structure and format, and transmit the information to the recipients indicated by the standing query.

A.2.1.3 Geospatial Information Packaging Services

Geospatial Information Packaging Services are composed of three service categories:

- Feature Compression Service
- Image Compression Service
- Geospatial Information Transfer Service

A.2.1.3.1 Feature Compression Service

The Feature Compression Service provides for conversion of vector and gridded portions of a feature collection to and from compressed form.

A.2.1.3.2 Image Compression Service

The Image Compression Service provides for conversion of an image to and from compressed form.

A.2.1.3.3 Geospatial Information Transfer Service

Geospatial Information Transfer Services are those required to build, access and manipulate the fundamental units and collections of MCG&I information to be transferred between MCG&I Domain-compliant application services in fulfilling their users' requests.

- "Geospatial information" refers to MCG&I objects, metadata, and annotations, and may include, but is not limited to: imagery, vector, text, video, signals, and any other appropriate form of data.
- "Geospatial information" may also include object behaviors such as methods written in a scripting or programming language that express functional capabilities of MCG&I objects.
- The term "fundamental units and collections" of MCG&I information refers to both simple and compound objects.

A.2.2 Feature Generalization Services

The Feature Generalization Services (FGS), shown in Figure A-2, are a category of services that modify the characteristics of a feature collection to increase the effectiveness of communication by counteracting the undesirable effects of data reduction. These services include capabilities to:

- Select to display or extract only those features that match certain criteria
- Suppress the display or extraction of features that match certain criteria

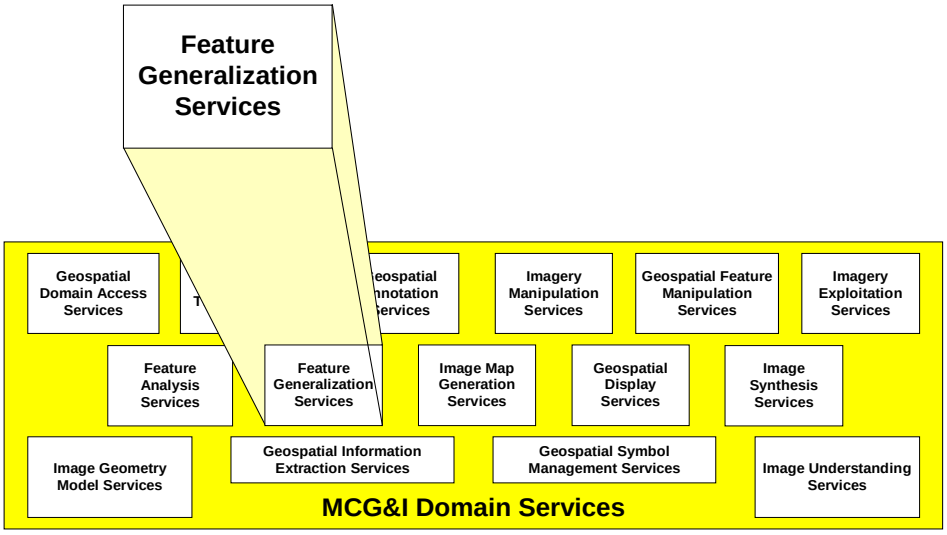


Figure A-2. USIGS Feature Generalization Services

- Aggregate clusters of point features and create a smooth enclosed polygonal perimeter outline
- Replace the current representation of a feature with a more detailed representation
- Reduce the sinuosity of line features or the perimeter of area features to avoid cluttering in a display window
- Reduce the number of features selected or displayed in a region to present a more pleasing representation of the region, based on a set of properties and/or criteria that are used as a prioritized filter
- Adjust the connectivity relationships of line segments in line, area, or volume features
- Classify features by assigning values to feature properties
- Replace any feature type with another feature type to adjust for changes in resolution of the Feature Collection (for example, replace an area feature with a point or line feature, or a volume feature with a point, line, or area feature, or the inverse of any of these.)
- Remove excessive variations in ridge/course line values to present a more pleasing representation of the ridge/course line skeleton
- Remove excessive variations in surface property values to present a more pleasing representation of the surface

A.2.3 Geospatial Information Extraction Services

Geospatial Information Extraction Services (GIES), shown in Figure A-3, are a category of services that support the extraction of feature and terrain information from remotely sensed and scanned images. These services include capabilities to:

- ingest existing feature collections
- digitize and/or convert softcopy maps and charts to produce a feature collection
- create the geometry and associated feature collection from a subset of another feature collection (e.g., extracting portions of map files to a specified area of interest (AOI), creating a coverage subset of feature information from Feature Collections from databases, capturing textual (Line, Area) properties and metadata, etc.)
- create a duplicate copy of an existing feature, set of features, or Feature Collection for the purpose of modifying that data or including it in a different set of data

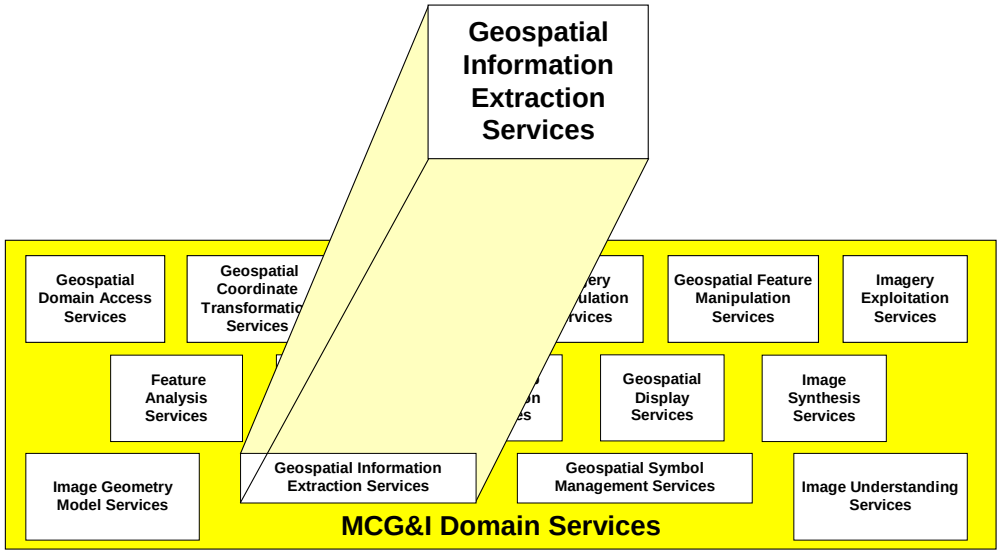


Figure A-3. USIGS Geospatial Information Extraction Services

A.2.4 Geospatial Coordinate Transformation Services

Geospatial Coordinate Transformation Services (GCTS), shown in Figure A-4, comprise capabilities for converting geospatial coordinates from one reference system to another. This includes the ability to:

- adjust the features in a Feature Collection using one datum and register them to another Feature Collection using a different datum
- transform geographic coordinate values from one coordinate system to another

- perform a point location search from user-entered coordinates according to user-specified coordinate types (i.e., UTM, geographic coordinates and image coordinates)

- apply standard, custom, or computer-generated grids over all imagery types

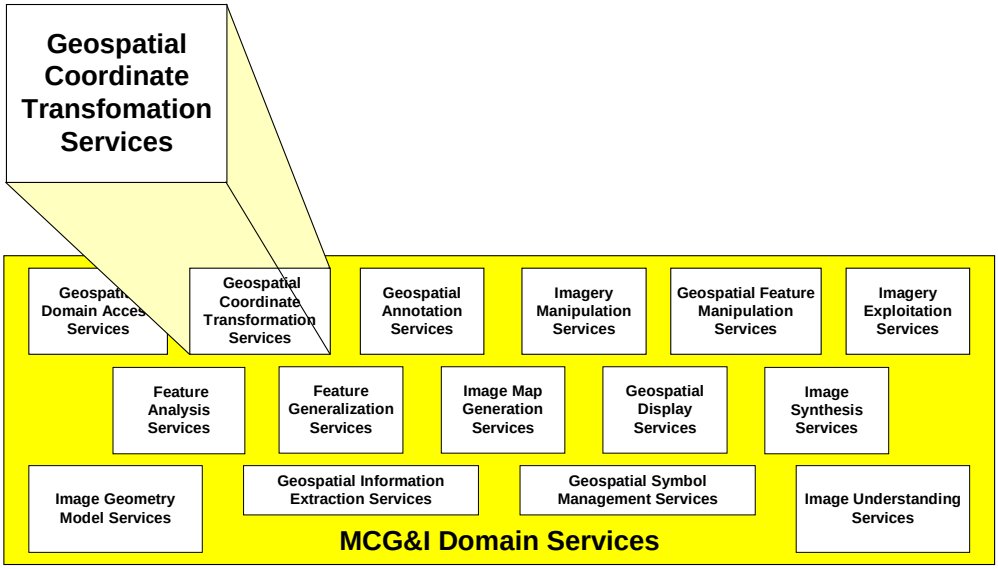


Figure A-4. USIGS Geospatial Coordinate Transformation Services

A.2.5 Geospatial Annotation Services

Geospatial Annotation Services (GAS), shown in Figure A-5, add ancillary information to an image or a feature in a Feature Collection (e.g., by way of a label, a hot link, or an entry of a property for a feature into a database) that augments it or makes it more complete.

The Image Annotation Services provides for standard interfaces to software tools that enable symbols, graphics, text, and other media types to be overlaid upon, or attached to, images to highlight significant content. Capabilities of this service will include:

- Superimposition of annotations on an image allowing for the exhibition of the annotation overlay, the image itself, or both

- Selection of icons and other symbols from a standardized catalog for placement on an overlay

- Retention of an annotation elements' position relative to the underlying image regardless of the action or manipulation performed on the image

- Registration of annotations to user-specified points on the display of the image.

Similarly, the Feature Annotation Services provides for the capability to add ancillary information to a feature in a Feature Collection (e.g., by way of a label, a hot link, or an entry of an attribute for a feature into a database) that augments or provides a more complete description of the feature.

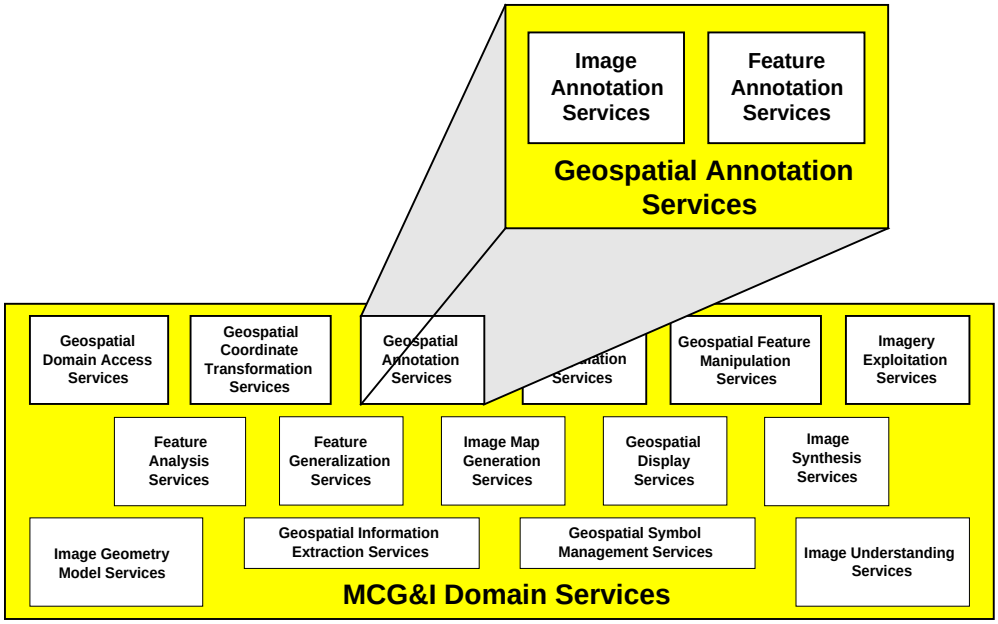


Figure A-5. USIGS Geospatial Annotation Services

A.2.6 Imagery Manipulation Services

Imagery Manipulation Services (IMS), shown in Figure A-6, provide for manipulating images (resizing, changing color and contrast values, applying various filters, manipulating image resolution, etc.) and for conducting mathematical analyses of image characteristics (computing image histograms, convolutions, etc.). These services include services to:

- Provide image enhancements that increase the analyst's ability to distinguish between similar appearing areas of a scene

- Perform geometric operations that change the digital image geometry in a controlled way, so that objects in the resultant image are displaced from their original positions (Note: These are basic image geometry service(s) used by applications and other services, defined elsewhere in this section)

- Manage the manipulation and display of images including the ability to pan, zoom, rotate, and display image histogram characteristics, local pixel properties, and display lookup tables

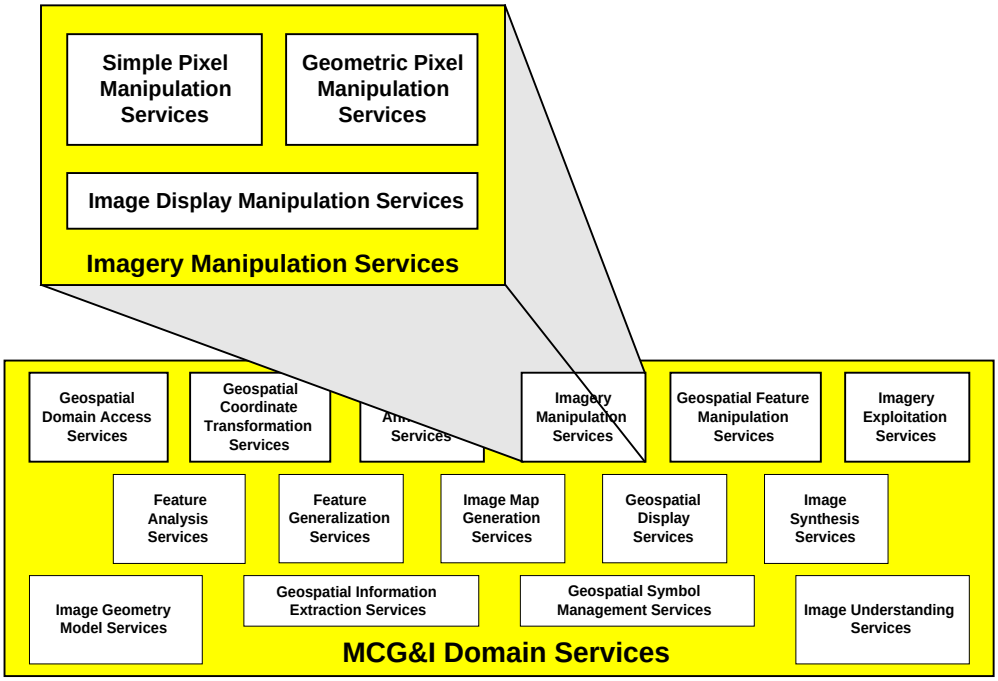


Figure A-6. USIGS Imagery Manipulation Services

A.2.7 Geospatial Feature Manipulation Services

Geospatial Feature Manipulation Services (GFMS), shown in Figure A-7, are a category of services that support creation, quality control methods, analysis, display, and generalization of feature collections of interest to an end user. They include capabilities to:

- Register one feature to another, an image, or another data set or coordinate set; correcting for relative translation shifts, rotational differences, scale differences, and perspective differences
- Examine the internal correctness and consistency of features and their properties as represented in a Feature Collection. This includes the ability to:
  - Adjust the locations of features that have portions of a whole feature separately represented in adjacent Feature Collections to ensure that the feature portions are properly aligned
  - Verify that all features in the Feature Collection are topologically consistent according to the topology rules of the Feature Collection, and identifies and/or corrects any inconsistencies that are discovered
  - Verify that all pixels or grid post values in a Coverage or Feature Collection are reasonable, identifies and/or corrects any inconsistencies that are discovered

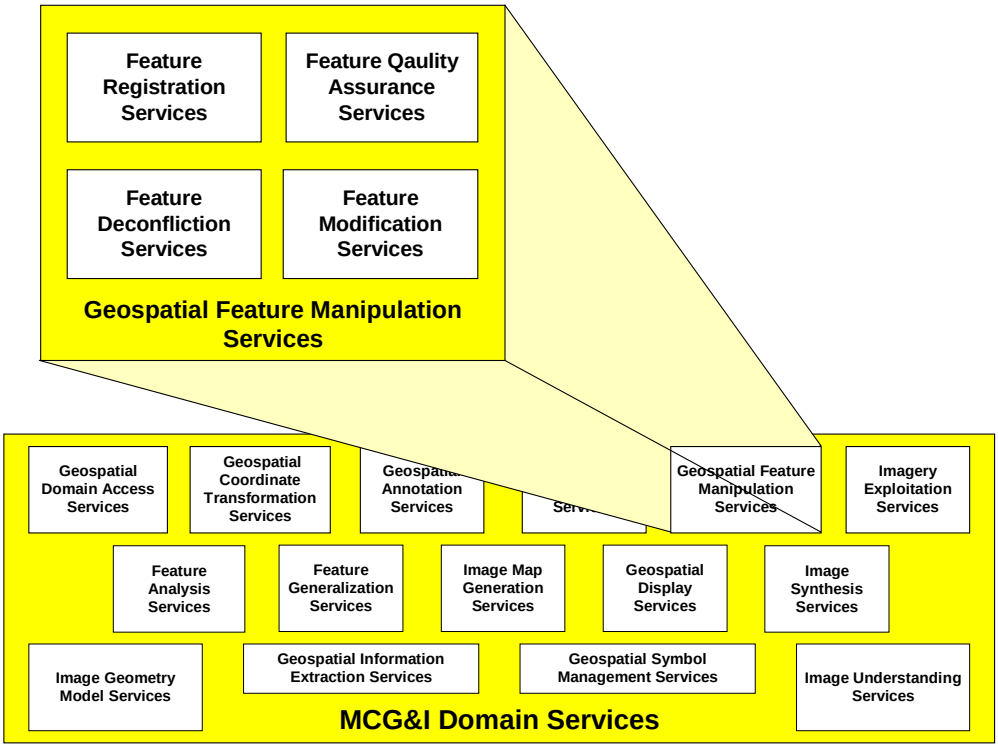


Figure A-7. USIGS Geospatial Feature Manipulation Services

- Deconflict features by applying mediative measures to resolve conflicts in data integrity or representation between or among different Feature Collections that contain similar information for a given area
- Modify values of a feature
- Modify the values of metadata elements describing a feature

A.2.8 Imagery Exploitation Services

Imagery Exploitation Services (IES), shown in Figure A-8, are required to support the photogrammetric analysis of remotely sensed and scanned imagery, the generation of reports with respect to the results of the analysis, and other products that ultimately reach policy and decision makers and other consumers of the results of photogrammetric analysis. These services measure the spatial characteristics of objects appearing within images, including geometric measurements from monoscopic and stereoscopic imagery, under a variety of acquisition conditions.

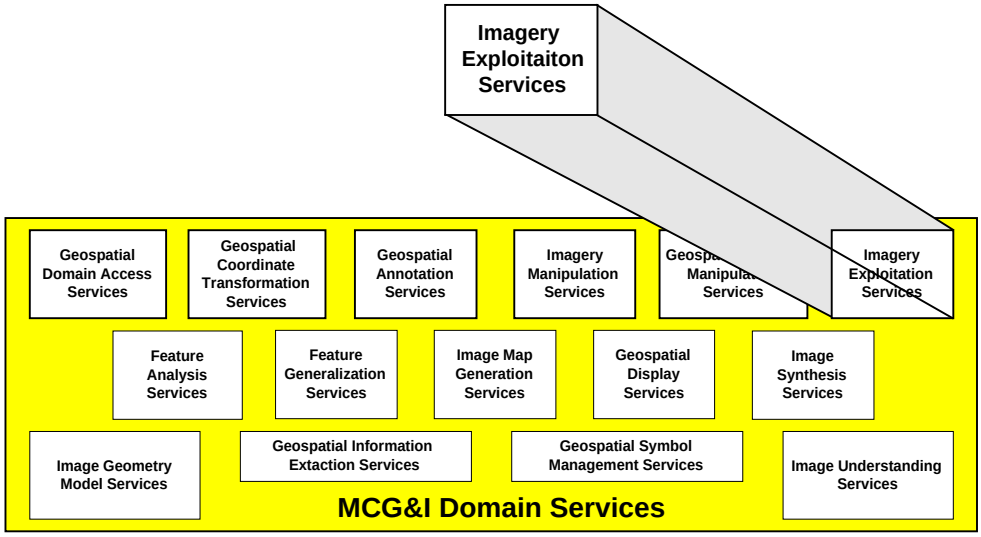


Figure A-8. USIGS Imagery Exploitation Services

A.2.9 Feature Analysis Services

Feature Analysis Services (FAS), shown in Figure A-9, are a category of services that exploit information available in a Feature or Feature Collection to derive application-oriented quantitative results that are not available from the raw data itself. These services include, but are not limited to, the following capabilities:

- Buffering to create a proximity zone of a specified width around the geometry of a feature or set of features in a Feature Collection or Coverage
- Boolean operations to perform binary operations on two or more features or feature collections including, but not limited to:
  - Union operations to compare features from two or more Feature Collections and return non-redundant features that are found in either Feature Collection.
  - Intersection operations to compare features from two or more Feature Collections and return those features that those Feature Collections have in common.
  - Fusion operations to merge two or more features or Feature Collections into an aggregate feature or Feature Collection composed of the formerly distinctly separate parts.
  - Operations to compare two Feature Collections and return the differences between them.
- Capability to determine if any features in the Feature Collection obstruct the path of a designated vehicle based on the properties of the features and those of the vehicle.

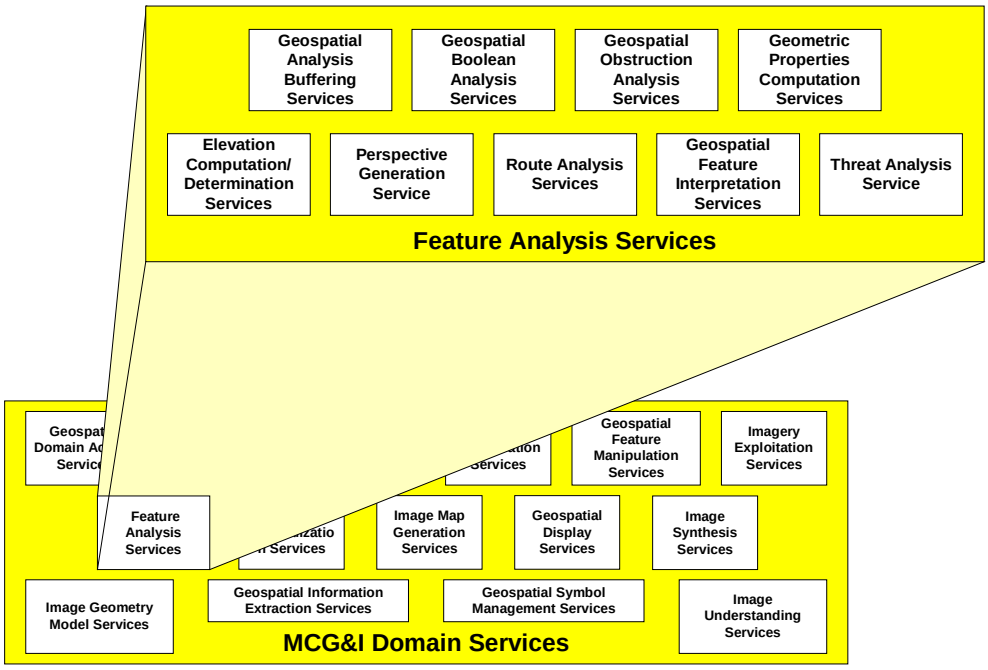


Figure A-9. USIGS Feature Analysis Services

- Capability to compute non-stored geometric properties, including relative and absolute error, of a feature from the geometry including, but not limited to, capabilities to:
  - Determine the size of an area feature.
  - Determine the length of a line feature or a straight line connecting two different points of a feature.
  - Determine the angular orientation of a feature, or a line connecting two different points or features, as measured from a standard vector (usually True North).
  - Determine the angular variation of a feature, or a line connecting two different points or features, as measured from a horizontal plane.
  - Transform feature geometry and/or attribute data values from one measurement system to their equivalent value representation in another measurement system.
- Computation services for exploiting elevation coverages and certain other coverages including, but not limited to, capabilities to:
  - Estimate the elevation of a specified point based on its position relative to a set of known elevation values.
  - Determine the average elevation of a Feature Collection based on grid post elevations as input.
  - Identify the highest and lowest property values of a surface in a Feature Collection.

  - Create a terrain profile object derived from an elevation-based Feature Collection.
  - Create a set of lines of equivalent values based on the information available in the Feature Collection.
  - Determine the angle of ground slope from the horizontal at specified points.
  - Determine those ground areas visible and those areas that are hidden as viewed from a specified point.
  - Calculate whether a specified feature is visible from a specified observation point.
  - Convert surface representations between any pair of Grid/TIN/Contour elevation coverage types.
- Capability to create a geospatial model of one or more related Feature Collections using visual cues to give the impression of depth as viewed from a specified angle.
- Capability to interpret feature properties.
- Computation services for exploiting transportation routes recorded as a Feature Collection, such as determination of:
  - The optimal path between two specified points based on the desired input parameters and properties contained in the Feature Collection.
  - Additional paths, other than the optimal path, between two specified points based on the desired input parameters and properties contained in the Feature Collection.
  - The measured distance between two points along a specified path based on the properties supported in the Feature Collection.
  - The length of time it takes to follow a route through the geospatial data in the Feature Collection.
- Services for computing threats using geospatial data recorded as a feature collection, such as:
  - Synthesis of the results of all previously calculated threat fans to arrive at a composite area that is vulnerable to attack.
  - Determination of whether a specified feature is detectable from a specified observation point.
  - Determination of the perimeter of an area feature that is subject to attack based on the properties of a weapon at a known geographic position.
  - Specification of the threat parameters to be used to filter the information in the Feature Collection when performing a threat analysis.

A.2.10 Image Geometry Model Services

Image Geometry Model Services (IGMS), shown in Figure A-10, are a category of services that support using mathematical models of image geometries. The geometries relate image positions to corresponding real-world (e.g., ground) positions. These services include, but are not limited to, the capability to:

- Use image geometry mathematical models to support image exploitation and manipulation (including supporting various other services that handle images), such as:
  - Computation of a list of image positions corresponding to a specified list of ground positions.
  - Computation of a list of ground positions corresponding to a specified list of image positions. The ground heights are either input as specific values, input as an elevation model, or computed using positions in two or more stereoscopic images.
  - Computation of estimated total ground position error of one point, including the effects of image support data errors, image position measurement errors, height uncertainty, and computation errors.
  - Computation of estimated total ground position error between two points, including the effects of image support data errors, image position measurement errors, height uncertainty, and computation errors.
  - Computation of estimated total image position error, at one ground position, including the effects of image support data errors, ground position errors, and computation errors.
  - Retrieval of the list of current values of image geometry model parameters.
  - Change of current values of specified image geometry model parameters.
  - Change of current values of image transformation parameters (from named value list format). This image transformation relates one version of an image to the original image. A version may be a reduced resolution data set, a simply warped image, and/or a part of the original image.
  - Retrieval of definitions of image parameters, including all information needed to allow display of parameter values and interactive modification of changeable values.

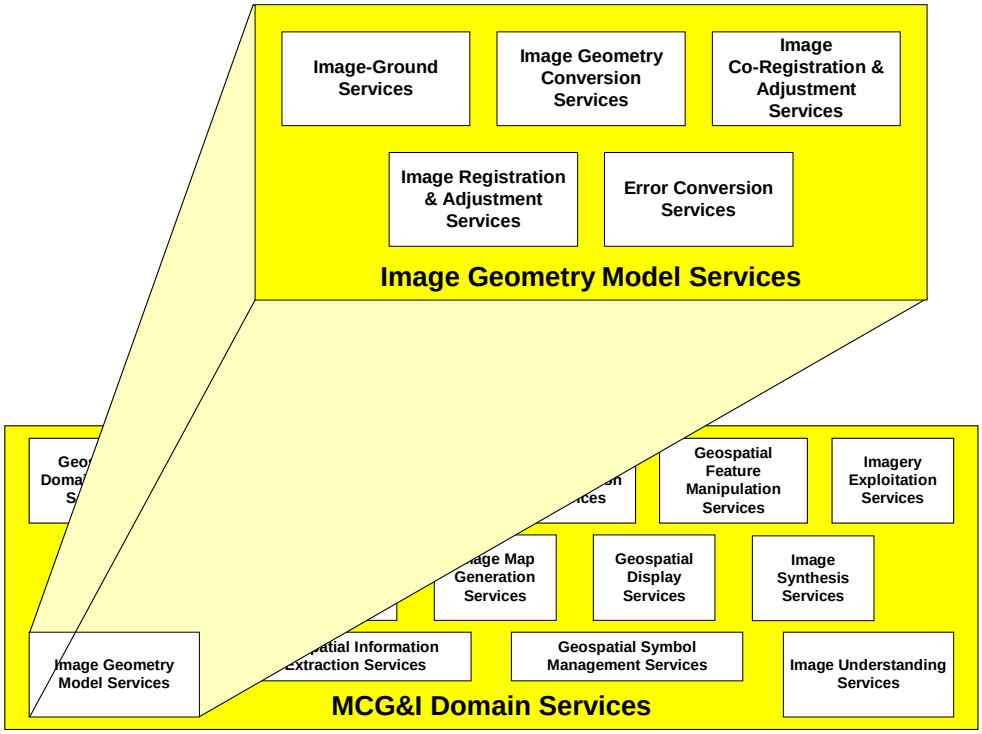


Figure A-10. USIGS Image Geometry Model Services

- Convert image geometry mathematical models into different, but equivalent, geometry models. These geometry models include image geometry parameter values in various specific, image-support, data formats. Operations on geometry models include, but are not limited to, the capability to:
  - Fit a new image geometry model to an existing image geometry model, including computing the estimated errors in the new image geometry model.
  - Receive and check image support data in a specific known format, for one or more images.
  - Retrieve and check the image support data for a specified image, and use this data to create an Image Geometry Use object.
  - Retrieve and check image support data for two or more stereoscopic images, and use this data to create multiple Image Geometry Use objects.
  - Convert image support data from an Image Geometry Use object to external format, including check and store converted data.
  - Convert image support data from two or more Image Geometry Use objects to external format, including check and store converted data.

  - Produce image support data in specified external format from previously entered data, for one or more images. Also, check the image support data and return a list of any “errors” or missing data detected.
  - Change current values of conversion service option parameters (in named value list format).
  - Retrieve current values of conversion service option parameters (in named value list format).

- Adjust one or more image geometry mathematical models to better match other images and/or known ground positions. Adjust geometry models based on corresponding ground and image positions and/or corresponding positions in multiple images, with the estimated errors in these positions and in the original image geometry parameters. Adjustments include, but are not limited to, the capability to:

  - Adjust the values of selected adjustable image geometry parameters for the current set of images, using position data for the current set of points.
  - Add an additional image to the current set of images to be adjusted.
  - Remove a specified image from the current set of images to be adjusted.
  - Add an additional point to the current set of points to be used in image adjustment.
  - Remove a specified point from the current set of points to be used in image adjustment.
  - Change data for a specified point in the current set of points to be used in image adjustment.
  - Change current values of image geometry adjustment service option parameters (in named value list format).
  - Retrieve current values of image geometry adjustment service option parameters (in named value list format).
  - Retrieve data for first point in current set of points to be used in image adjustment.
  - Retrieve data for next point in current set of points to be used in image adjustment, after last point retrieved by Get Next Point or by Get First Point.
  - Retrieve data for a selected point in set of points to be used in image adjustment.
  - Retrieve summary data for first image in current set of images to be adjusted.
  - Retrieve summary data for next image in current set of images to be adjusted, after last image retrieved by Get Next Image or by Get First Image.

- Support adjustment of image geometry parameters, such as:

  - Retrieve names of all parameters of the image geometry model that could be adjusted.
  - Retrieve names of parameters of the image geometry model that are recommended to be adjusted.

  - Retrieve covariance matrix of the current expected errors in and among a specified list of image geometry model parameters.
  - Compute partial derivatives of the image coordinates relative to specified list of adjustable image geometry model parameters, evaluated at a specified ground position.
  - Compute partial derivatives of the image coordinates relative to the three ground coordinates, at a specified ground position.
  - Change values of specified list of parameters of the image geometry model, by the specified value changes.
  - Change covariance matrix of the expected errors in and among a specified list of image geometry model parameters.
  - Compute list of image positions corresponding to specified list of ground positions.
  - Compute list of ground positions corresponding to specified list of image positions. The ground heights are either input as specific values, input as an elevation model, or computed using positions in two or more stereoscopic images.

- Convert estimated errors between covariance matrix form and Circular Error (CE) plus Linear Error (LE) forms. These conversions include, but are not limited to:

  - Conversion of a 3-D covariance matrix to horizontal CE and vertical LE estimates.
  - Conversion of a 2-D covariance matrix to horizontal CE estimate.
  - Conversion of a 2-D covariance matrix to image CE estimate.
  - Conversion of a horizontal CE and vertical LE estimates to 3-D covariance matrix.
  - Conversion of a horizontal CE estimate to 2-D covariance matrix.
  - Conversion of an image CE estimate to 2-D covariance matrix.
  - Changes of current values of accuracy conversion service option parameters. These options include the confidence probability used for CE and LE.
  - Retrieval of current values of accuracy conversion service option parameters.

A.2.11 Geospatial Symbol Management Services

Geospatial Symbol Management Services (GSMS), shown in Figure A-11, are those services required for the management of symbol libraries, such as:

- Management of symbol libraries, the linking of symbol types to specific features for display, and the representation of symbols as proxies for features in legends and portions of Feature Collections displayed on a screen or printed hardcopy.

- Creation of a taxonomy of symbols from a set of graphic objects to populate one or more symbol libraries.

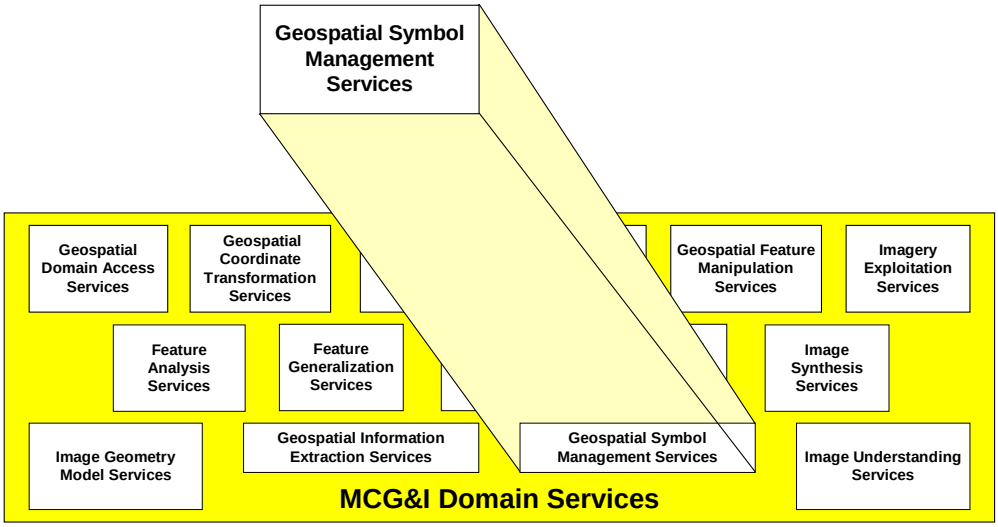


Figure A-11. USIGS Geospatial Symbol Management Services

A.2.12 Image Map Generation Services

Image Map Generation Services (IMGS), shown in Figure A-12, are a collection of services for manipulating and combining images for use as image maps and other uses. These services include, but are not limited to, the capability to:

- Merge multiple images with abutting and/or overlapping spatial coverages to form a single composite with greater spatial coverage.

- Match and blend the radiometric values of corresponding or adjacent pixels from abutting and/or overlapping spatial coverages to form a smooth visual transition.

- Combine information from more than one image into a single image product (e.g., combining one image from SPOT 10m. resolution panchromatic coverage with one of LANDSAT 30m. resolution multi-spectral coverage).

- Adjust transparency of images so when two images are overlaid one upon the other, adjustment is made to common pixel values to allow lower-layered images to be observed through higher-layered images. This capability is typically used to combine images from different sensors with different imaging characteristics, such as combining a panchromatic image and a thematic mapper image into a single color image that allows thematic classifications to be viewed “through” the panchromatic image.

- Transformation of the geometry of images to remove the effect of obliquity and/or rotation in the image acquisition (known as rectification). This capability includes epipolar rectification for stereoscopic viewing.

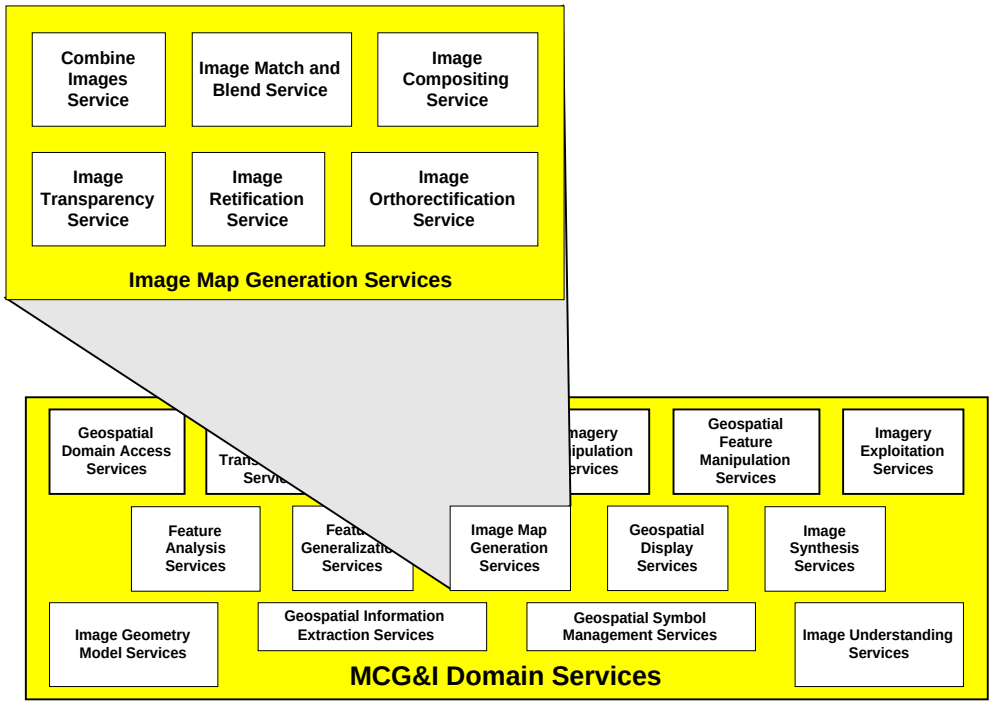


Figure A-12. USIGS Image Map Generation Services

- Transformation of the geometry of images to remove the effect of obliquity in image acquisition and also remove lateral displacement due to terrain relief (known as orthorectification).

A.2.13 Image Synthesis Services

Image Synthesis Services (ISS), shown in Figure A-13, is a category of services for creating or transforming images using computer-based spatial models, perspective transformations, and manipulations of image characteristics to improve visibility, sharpen resolution, and/or reduce the effects of cloud cover or haze. These computations include, but are not limited to, the capability to create:

- CAD or other models of elements and objects within an imaged scene.
- A new image from an existing image to simulate changes in acquisition conditions such as illumination, atmospheric effects, or sensor geometry.
- An image as though taken from a location other than that of the original image. Generally, this uses a three-dimensional scene model.
- A series of images with perspective centers changing with observation time as though taken from an aircraft (for example) flying over the scene.

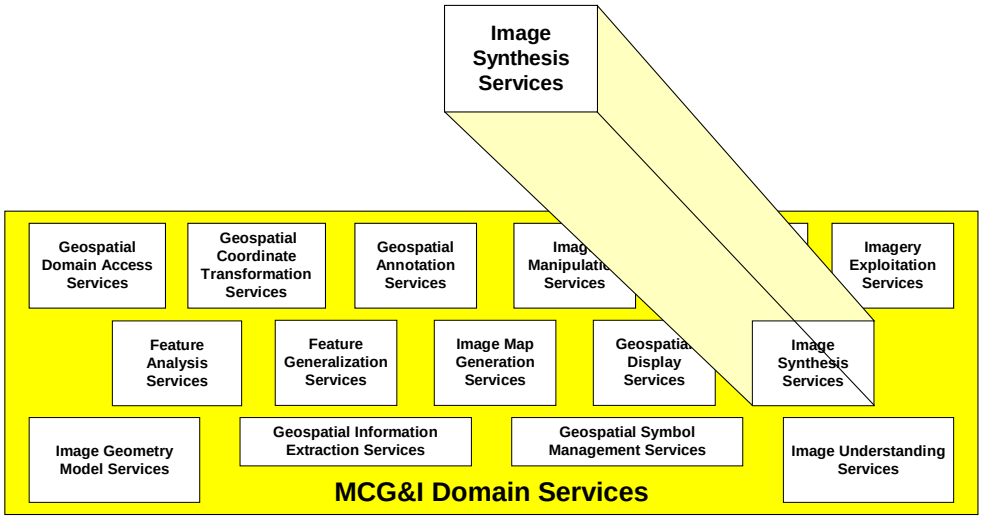


Figure A-13. USIGS Image Synthesis Services

A.2.14 Image Understanding Services

Image Understanding Services (IUS), shown in Figure A-14, are a category of services that provide automated image change detection, registered image differencing, significance-of-difference analysis and display, and area-based and model-based differencing. Capabilities included in this category include, but are not limited to:

- Comparison of multiple images taken at different times, highlighting areas where significant change has occurred; e.g., the absence of an aircraft where one previously was parked.
- Pattern recognition on an image. Pattern recognition is a capability that detects the existence of a pre-defined or learned pattern, such as edges joined in right angles.
- Identification and classification of objects in an image. Object recognition is based on fully automated or computer-assisted recognition of patterns, from which detection of a known class of object can be inferred (based on prior classification).

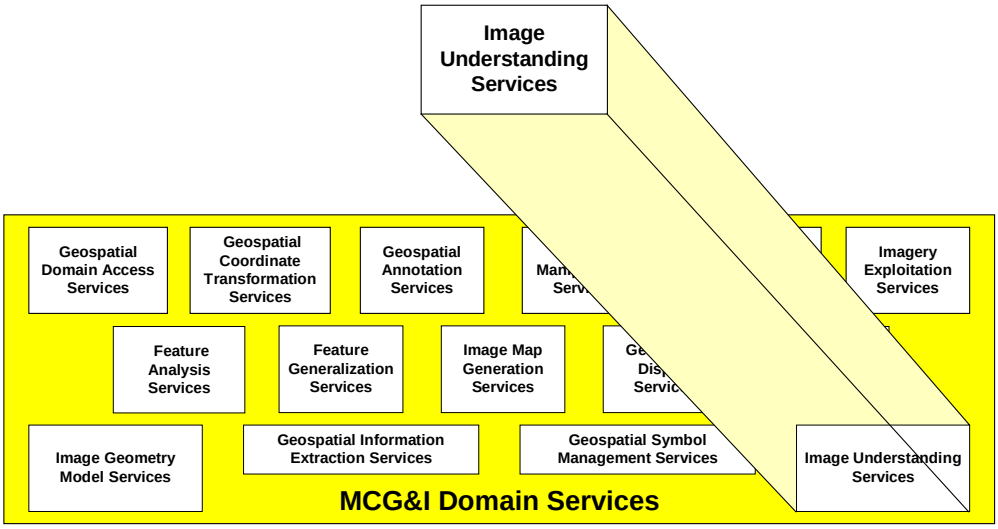


Figure A-14. USIGS Image Understanding Services

- Extract of features from an image based on object recognition. Feature extraction implies the detection and identification of an object but further includes the abstraction (or symbolization) of the feature. For instance, detecting, extracting, and abstracting a feature such as a road into a spatial data base or map.

- Display, extraction, and analysis of terrain data. Examples of terrain data of interest are: elevation data, soil types, vegetation classes, and drainage patterns. An example of terrain analysis is the use of digital elevation data with images to generate obscuration profiles, showing visual or signal obscuration between selected points.

- Automatic and interactive negation (determination of origin) of changes detected in objects and relations (e.g., performs site analysis using knowledge-based analytical methods.

- Automatic and interactive detection and counting of objects and relations required for an exploitation task (e.g., perform automatic target recognition).

- Automatic and interactive trend analysis for objects and relations of interest in an exploitation task (to include spatial inference from evidence of as-yet unseen, occluded, or otherwise obscured objects, as well as model analysis using time-series and machine learning techniques).

- Automatic and interactive analysis of sensor line-of-sight, terrain and cultural feature classifications (including standard map features and point target types), vehicle- and unit-level location probabilities, mobility analysis, etc.

A.2.15 Geospatial Display Services

Geospatial Display Services (GDS), shown in Figure A-15, is comprised of services that prepare and render one or more Feature Collections or Coverages to an output device. The output device may be a (temporary) electronic display or (permanent) hardcopy printer (e.g., printing a map or chart). The services include, but are not limited to capabilities that:

- Manipulate one or more Feature Collections or Coverages to display over a base Feature Collection that is already displayed (this includes such applications as distributed collaborative computing).
- Create associations, either temporary or permanent, between or among features in a Feature Collection, symbols in an overlay, etc., for the purpose of their display manipulation as a related unit.
- Introduce detail into a feature to augment or emphasize a particular characteristic.
- Interactively select and highlight a feature or features displayed on the display device.

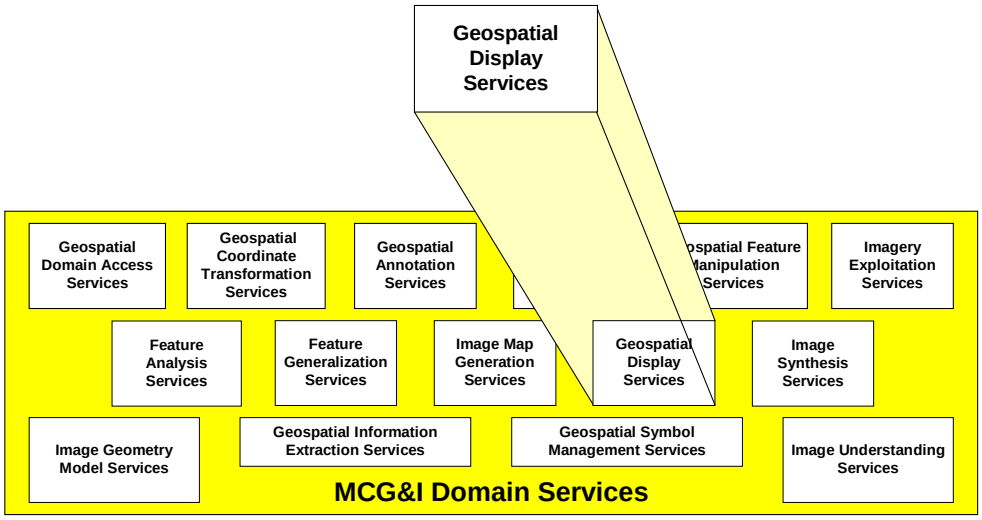


Figure A-15. USIGS Geospatial Display Services

- Link symbol types from symbol libraries to specific features in a Feature Collection for representation on the output device.
- Render a Feature Collection that has been encoded with symbolized information, to an output device or media.
- Place textual information during the rendering process to provide a more complete description of a feature or set of features.

- Associate ancillary information for a feature or feature collection for display with the feature or feature collection on the output device.

- Manage the output of hardcopy facsimiles of the Feature Collection via a device such as a printer or plotter.

- Display a map inset containing a smaller-scale map to which the geographic position of the displayed map or area of interest is referenced.

- Convert the features in the Feature Collection from one projection system to another to enable their accurate rendering to an output device.

- Control how the Feature Collection is manipulated in a display screen window.

- Specify the Feature Collection, or portion of the Feature Collection (the subset usually resulting from the application of an Area Of Interest as a filter), to be displayed as a map background.

- Specify the scale at which to display the Feature Collection on the output device.

- Instruct the display to lighten the illumination intensity of the feature or Feature Collection in the screen display window.

- Specify in which direction the feature or Feature Collection is to be moved in the screen display window.

- Reposition the Feature Collection in the screen display window in relation to a specified center point that is different from the center point used in the current display of the Feature Collection.

- Specify an angular measure by which the feature or Feature Collection are to be turned about a specified center point.

- Specify a zoom factor for redisplay of the feature or Feature Collection on the screen.

- Stack features, Feature Collections, or Coverages in a specified order for output to a display device.

- Adjust the position of a feature to avoid overlap with other features that would cause cluttering in the display window.

Appendix B: UTA Relationship with DII COE

B.1 JTA Mandate for DII COE

The following paragraphs are quoted from [JTA98, Section 2.1.4.2]:

> The Common Operating Environment (COE) concept is described in the Integration and Runtime Specification (I&RTS), Version 3.0, 1 July 1997. The Defense Information Infrastructure COE (DII COE) is implemented with a set of modular software that provides generic functions or services, such as operating system services. These services or functions are accessed by other software through standard APIs. The DII COE may be adapted and tailored to meet the specific requirements of a domain. COE Implementations provide standard, modular software services that are consistent with the service areas identified in the DoD Technical Reference Model. Application programmers then have access to these software services through standardized APIs.
>
> The DII COE, as defined in the DII COE I&RTS Version 3.0, is fundamental to a Joint System Architecture (JSA). In the absence of a JSA, the JTA mandates that all Command, Control, Communications, Computers, and Intelligence (C4I) systems shall use the DII COE. The strict definition of C4I, as given in JTA 1.0, is expanding to cover information technology areas that cut across JTA Version 2.0 domain boundaries. The DII COE mandate is therefore intended for all applicable systems. All applications of a system which must be integrated into the DII shall be at least DII COE I&RTS level 5-compliant (software is segmented, uses DII COE Kernel, and is installed via COE tools) with a goal of achieving level 8.
>
> The DII COE implements the appropriate JTA standards applicable to the COE functionality. The DII COE implementation will continue to evolve in compliance with all applicable JTA specifications, standards, and source references. Additional functionality not contained in the DII COE is subject to the JTA mandate.

Be aware that use of the COE is not a complete substitute for compliance with the standards in the UTA and JTA. *Services not contained in the DII COE are still subject to the UTA- and JTA- mandated standards*.

The COE is still under development and many service areas are not completely compliant with the mandated JTA standards. These discrepancies are recorded in DII COE documents. Waivers documenting this non-compliance with the JTA *are the responsibility of the DII COE Chief Engineer* and are not required for individual programs implementing the COE.

B.2 DII COE Architecture and the UTA

The DII COE specification is presented in the DII COE Baseline Specification, Version 3.1 [COE97]. The COE architecture is shown in Figure B-1. The DII COE I&RTS describes the technical requirements for using the DII COE and SHADE to build and integrate systems [I&RTS97].

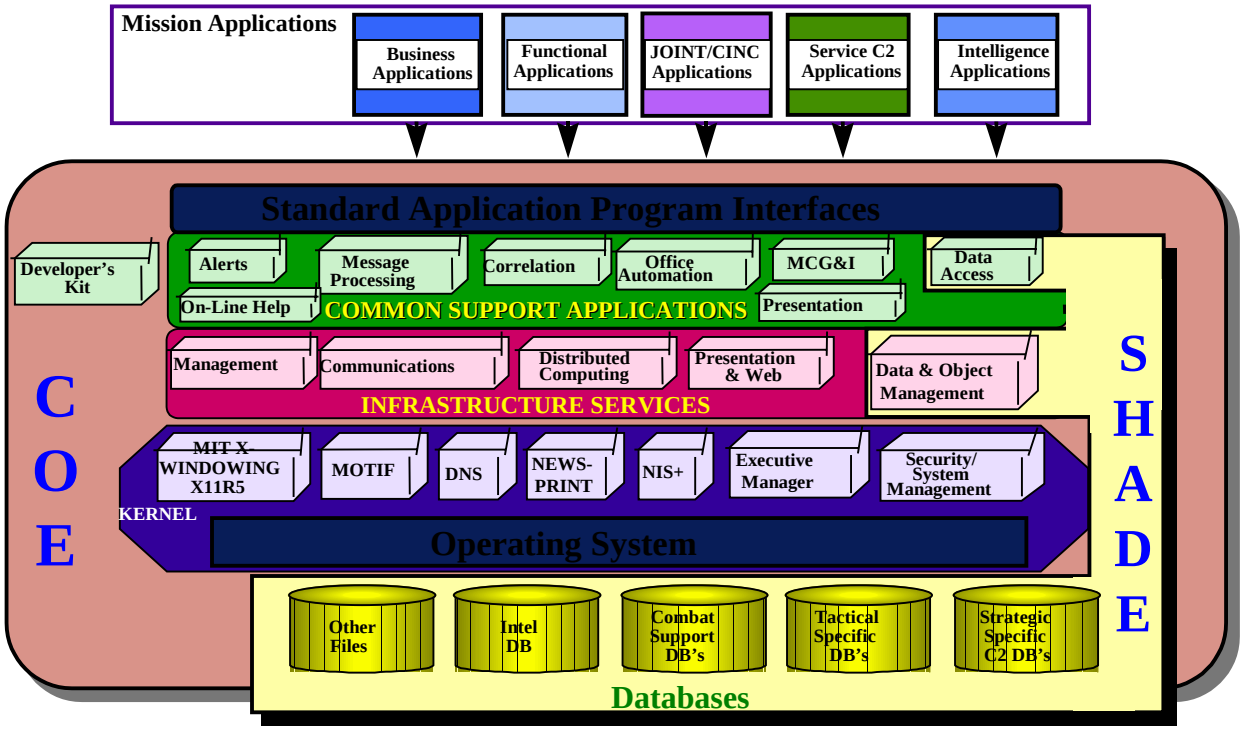


Figure B-1. DII COE Architecture

The USIGS adaptations are to two specific components of the DII COE. USIGS Mission Applications can be regarded as DII COE Mission (Figure B-2). USIGS MCG&I Services are components within the MCG&I Common Support Applications category (Figure B-3). To date, discussion of MCG&I services for the DII COE has focused on the Joint Mapping Tool Kit (JMTK). NIMA's goal is to establish a roadmap for the integration of future applications/services into the DII COE that encompass the broader needs of the IGC. These needs are currently represented by the MCG&I services.

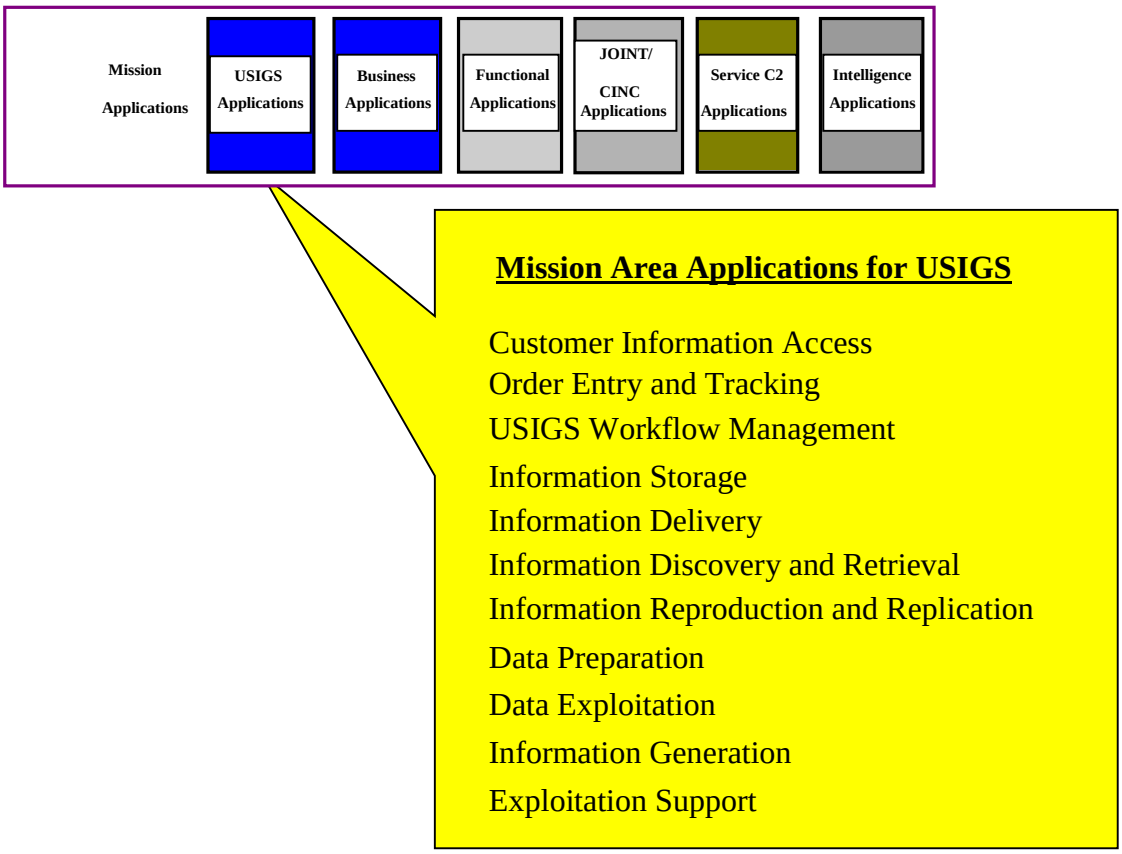
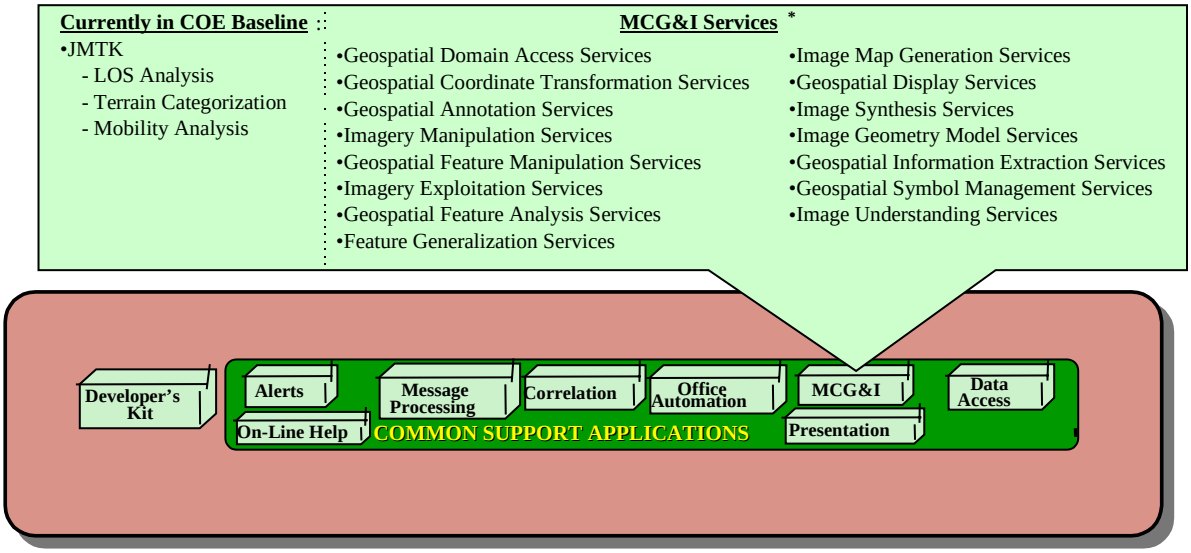


Figure B-2. DII COE Architecture Extended to Show USIGS Mission Area Applications



* Only JMTK-Provided Services Currently in COE
* Based upon the OGC's OpenGIS Services Architecture

Figure B-3. DII COE Architecture Extended to Show USIGS MCG&I Services

DII COE Common Support Applications (CSA) are typically stand-alone applications that have their own user interface and provide services of a general, or generic, type to any user. Descriptions of some of the DII COE CSAs are presented in Table B-1.

Table B-1. DII COE Common Support Application Categories

Office Automation Services	Alerts Services	MCG&I Services	Messaging Services
Word processing Spreadsheet E-mail Presentation graphics Web browser Workflow management This category also includes on-line support as well as other productivity-enhancing functions.	Responsible for routing and managing alert messages throughout a system. Service areas include the delivery, display, queuing, suspension, and highlighting of system alerts	Provide a common set of services for the access, display, exploitation, analysis, exchange, and creation of geospatial and imagery-related data	Message receipt from a communications front end Internal message routing The generation, coordination and release of outbound messages Data normalization Storage and retrieval Message profiling; and Format validation

Appendix C: NIMA Product Specifications and Standards

Table C-1. NIMA Product Specifications and Standards

Document Number	Document Title	Ed.	AM or CN*	Date
CIO-3P-004-95	United States Imagery System Directive 2-1 Exploitation and Reporting Structure (EARS) (S) (Short Title: EARS-1)		CN 03	1/19/95
CIO-3P-005-95	United States Imagery System Directive 2-1.1 Exploitation and Reporting Structure (EARS): Electronic Reporting (F) (Short Title: EARS-1.1)		0	2/9/95
CIO-3P-006-95	Addendum to United States Imagery System Directive 2-1.1 Exploitation and Reporting Structure (EARS): Electronic Reporting (S) (Short Title: EARS-1.1A)		CN 03	2/9/95
CIO-3P-007-95	United States Imagery System Directive 2-1.2 Exploitation and Reporting Structure (EARS): Hardcopy Reporting (F) (Short Title: EARS-1.2)		CN 01	2/9/95
MIL-A-89400(DMA)	Air Target Chart (ATC)	1	0	1/31/95
MIL-B-89200	Bathymetric Navigation Planning Chart (BNPC) (C)	1	0	4/21/90
MIL-B-89200	Bathymetric Navigation Planning Chart (BNPC)	1	AM 2	11/27/92
MIL-C-89202A(DMA)	Combat Charts	2	0	4/29/95
MIL-C-89303	City Graphic	1	0	11/30/90
MIL-D-89010(DMA/Navy)	Digital Bathymetric Data Base (DBDB) 5 Minute		0	3/4/94
MIL-D-89029	Digital Bathymetric Data Base (DBDB) 0.1 Minute and 0 .5 Minute		0	1/27/95
MIL-G-89103	Gridded Installation Photograph (GIP)		0	5/4/94
MIL-G-89106	Gridded Airfield Photograph (GAP)		0	5/6/94
MIL-H-89201/1(DMA)	Harbor, Approach, and Coastal Charts-1 (HAC-1)	2	0	4/29/95
MIL-H-89201/2(DMA)	Harbor, Approach, and Coastal Charts-2 (HAC-2)	2	0	4/29/95
MIL-H-89201/3(DMA)	Harbor, Approach, and Coastal Charts-3 (HAC-3)	2	0	4/29/95
MIL-H-89201/4(DMA)	Harbor, Approach, and Coastal Charts-4 (HAC-4)	2	0	4/29/95
MIL-H-89201/5(DMA)	Harbor, Approach, and Coastal Charts-5 (HAC-5)	2	0	4/29/95
MIL-H-89201/6(DMA)	Harbor, Approach, and Coastal Charts-6 (HAC-6)	2	0	4/29/95
MIL-H-89201/7(DMA)	Harbor, Approach, and Coastal Charts-7 (HAC-7)	2	0	4/29/95
MIL-H-89201/8(DMA)	Harbor, Approach, and Coastal Charts-8 (HAC-8)	2	0	4/29/95
MIL-H-89201/9(DMA)	Harbor, Approach, and Coastal Charts-9 (HAC-9)	2	0	4/29/95
MIL-H-89201A(DMA)	Harbor, Approach, and Coastal Charts (HAC)	2	0	4/29/95
MIL-HDBK-850	Mapping, Charting, and Geodesy (MC&G) Terms		0	1/21/94
MIL-J-89100(DMA)	Joint Operations Graphic - Air/Ground (JOG A/G)	1	0	2/28/95
MIL-J-89401(DMA)	Joint Operations Graphic - Radar (JOG R)	1	0	1/31/95
MIL-O-89102(DMA)	Operational Navigation Chart (ONC)	1	0	1/31/95
MIL-P-89406	Point Positioning Data Base (PPDB) (S)		0	5/23/93
MIL-PRF-89020A	Digital Terrain Elevation Data (DTED) Levels 1 & 2	2	0	4/19/96
MIL-PRF-89023	Digital Nautical Chart (DNC)	1	0	12/19/97
MIL-PRF-89033	Vector Smart Map (VMap) Level 1	1	0	6/1/95
MIL-PRF-89038	Compressed ARC Digitized Raster Graphics (CADRG)		0	10/6/94
MIL-PRF-89039	Vector Smart Map (VMap) Level 0	1	0	2/9/95
MIL-PRF-89040A	Vector Product Format Interim Terrain Data (VITD)	2	0	5/8/96
MIL-PRF-89041	Controlled Image Base (CIB)	1	0	5/15/95
MIL-PRF-89041	Controlled Image Base (CIB)	1	AM 1	7/31/95

Document Number	Document Title	Ed.	AM or CN*	Date
MIL-R-89013	Relocatable Target Assessment Data (RTAD)		0	4/30/92
MIL-STD-2401	World Geodetic System 84 (WGS 84)		0	1/11/94
MIL-STD-2402(DMA)	MC&G Symbology for Graphic Products	1	0	4/21/95
MIL-STD-2407	Vector Product Format (VPF)	2	0	6/28/96
MIL-STD-2408(DMA)	MC&G Glossary of Feature and Attribute Definitions		0	4/21/95
MIL-STD-2408(DMA)	MC&G Glossary of Feature and Attribute Definitions		CN 1	5/24/95
MIL-STD-2408(DMA)	MC&G Glossary of Feature and Attribute Definitions		CN 2	8/30/95
MIL-STD-2410(NIMA)	MC&G Reproduction and Printing	1	0	1/31/95
MIL-STD-2411	Raster Product Format (RPF)		0	10/6/94
MIL-STD-2411	Raster Product Format (RPF)		CN 1	1/17/95
MIL-STD-2411/1	Registered Data Values for RPF		0	8/30/94
MIL-STD-2411/2	Integration of RPF Files into the NITFS		0	8/26/94
MIL-STD-2413(DMA)	Standard Linear Format (SLF) for Digital Cartographic Feature Data	1	0	8/16/95
MIL-STD-2414	DMA Stock Number Bar Coding	2	0	5/25/95
MIL-STD-600001	Mapping, Charting, and Geodesy (MC&G) Accuracy	1	0	2/26/90
MIL-STD-600011	DMA Single Color Overprint Revision Update	1	0	3/18/92
MIL-T-89101(DMA)	Tactical Pilotage Charts (TPC)	1	0	1/31/95
MIL-T-89301A(DMA)	Topographic Line Map (TLM) - 1:50,000	2	0	2/28/95
MIL-T-89301A(DMA)	Topographic Line Map (TLM) - 1:50,000	2	AM 1	
MIL-T-89304	Tactical Terrain Analysis Data Base (TTADB)		0	11/30/90
MIL-T-89304	Tactical Terrain Analysis Data Base (TTADB)		AM 1	11/30/92
MIL-T-89305A	Planning Terrain Analysis data Base (PTADB)		0	12/1/94
MIL-T-89306(DMA)	Topographic Line Map (TLM) - 1:100,000	1	0	2/28/95
MIL-V-89408	Video Point Positioning Data Base (VPPDB) (S)	1	0	7/30/91
MIL-W-89500	World Magnetic Model (WMM)	1	0	6/18/93
PS/1AC/140	Jet Navigation Charts (JNC)	1	0	11/1/80
PS/1AC/140	Jet Navigation Charts (JNC)	1	CN 1	4/1/81
PS/1AC/140	Jet Navigation Charts (JNC)	1	CN 2	11/1/81
PS/1AC/140	Jet Navigation Charts (JNC)		STYLE SHEET (H)	
PS/1AC/140	Jet Navigation Charts (JNC)		STYLE SHEET (V)	
PS/1AC/140	Jet Navigation Charts (JNC)		SYMBOL BOOK	
PS/1AC/141	Universal Jet Navigation Charts	1	0	2/1/81
PS/1AC/160	Jet Navigation Chart A Series	2	0	10/1/82
PS/1AD/200	Global Navigation and Planning Chart	1	0	10/1/81
PS/1AD/200	Global Navigation and Planning Chart	1	CN 1	6/1/88
PS/1AD/200	Global Navigation and Planning Chart	1	CN 2	6/1/89
PS/1AD/200	Global Navigation and Planning Chart		STYLE SHEET	8/1/87
PS/1AD/200	Global Navigation and Planning Chart		SYMBOL BOOK	
PS/1CM/100	World Mean Elevation Data (WMED)	1	0	1/1/85
PS/1CN/01	Local Slope Data (LSD)	1	0	1/1/85
PS/1DA/100	FF-18 Moving Map Display Navigational Filmstrip	1	0	8/1/82
PS/1DA/100	FF-18 Moving Map Display Navigational Filmstrip	1	CN 1	10/31/83
PS/1DA/102	FA-7 Projected Map Display System Navigational Filmstrip	1	0	12/1/82

Document Number	Document Title	Ed.	AM or CN*	Date
PS/1DA/110	FHH-53 PMDs Navigational Filmstrip	1	0	7/1/84
PS/1DA/150	Remote Map Reader Navigational Filmstrips	1	0	12/1/83
PS/1EA/403	Antisubmarine Warfare Plotting Chart	1	0	9/1/79
PS/1EA/403	Antisubmarine Warfare Plotting Chart	1	CN 1	3/1/80
PS/1EA/403	Antisubmarine Warfare Plotting Chart	1	CN 2	4/1/80
PS/1EA/403	Antisubmarine Warfare Plotting Chart	1	CN 3	5/1/80
PS/1EA/403	Antisubmarine Warfare Plotting Chart	1	CN 4	9/1/81
PS/1EA/403	Antisubmarine Warfare Plotting Chart	1	CN 5	9/1/81
PS/1EA/403	Antisubmarine Warfare Plotting Chart	1	CN 6	10/1/83
PS/1EB/500	Evasion Chart	1	0	5/1/89
PS/1EC/001	Hemisphere Plotting Chart	1	0	7/1/89
PS/1EC/401	Test Range Instrumentation Map	2	0	7/1/89
PS/1EC/407	Joint Planning Chart	1	0	12/1/79
PS/1EC/407	Joint Planning Chart	1	CN 1	10/16/80
PS/1EC/407	Joint Planning Chart	1	CN 2	5/27/81
PS/1EC/407	Joint Planning Chart	1	CN 3	8/1/82
PS/1EC/409	Antarctic Strip Chart	1	0	9/1/81
PS/1EC/410	NORAD Command Control Planning Charts	1	0	1/1/85
PS/1FA/004	DMA Annex to IACC-4 for DoD Flight Information Publication (Low Altitude) Instrument Approach Procedures Worldwide	2	0	7/1/90
PS/1FA/004	DMA Annex to IACC-4 for DoD Flight Information Publication (Low Altitude) Instrument Approach Procedures Worldwide	2	AM 1	10/1/91
PS/1FA/004	DMA Annex to IACC-4 for DoD Flight Information Publication (Low Altitude) Instrument Approach Procedures Worldwide	2	AM 2	5/1/92
PS/1FA/004	DMA Annex to IACC-4 for DoD Flight Information Publication (Low Altitude) Instrument Approach Procedures Worldwide	2	AM 3	7/1/94
PS/1FA/004	DMA Annex to IACC-4 for DoD Flight Information Publication (Low Altitude) Instrument Approach Procedures Worldwide	2	CN 1	3/1/95
PS/1FA/004	DMA Annex to IACC-4 for DoD Flight Information Publication (Low Altitude) Instrument Approach Procedures Worldwide	2	CN 2	2/18/98
PS/1FA/005	DoD Flight Information Publication Enroute Charts Worldwide	6	0	1/21/98
PS/1FA/007	DMA Annex to IACC-7 for DoD Flight Information Publication Standard Instrument Departures Worldwide	2	0	7/1/90
PS/1FA/007	DMA Annex to IACC-7 for DoD Flight Information Publication Standard Instrument Departures Worldwide	2	AM 1	10/1/91
PS/1FA/007	DMA Annex to IACC-7 for DoD Flight Information Publication Standard Instrument Departures Worldwide	2	AM 2	5/1/92
PS/1FA/007	DMA Annex to IACC-7 for DoD Flight Information Publication Standard Instrument Departures Worldwide	2	AM 3	7/1/94
PS/1FA/007	DoD Flight Information Publication Enroute Supplements	2	CN 1	2/18/98
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	0	12/1/87
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	AM 1	2/1/89
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 1	4/1/90
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 2	7/1/90
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 3	8/1/90
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 4	1/1/91
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 5	1/1/92
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 6	10/1/92
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 7	2/1/94
PS/1FA/010	DoD Flight Information Publication Enroute Supplements	2	CN 8	6/1/95

Document Number	Document Title	Ed.	AM or CN*	Date
PS/1FA/011	DoD Flight Information Publication VFR-Supplements	2	0	3/1/93
PS/1fA/011	DoD Flight Information Publication VFR-Supplements	2	CN 1	2/1/94
PS/1FA/013	DoD Flight Information Publication VFR Arrival/Departure Routes	5	0	12/1/89
PS/1FA/013	DoD Flight Information Publication VFR Arrival/Departure Routes	5	AM 1	1/1/90
PS/1FA/013	DoD Flight Information Publication VFR Arrival/Departure Routes	5	AM 2	7/1/94
PS/1FA/014	DMA Annex to Specification IACC-14 for DoD Flight Information Publication Standard Terminal Arrival Charts Worldwide	1	0	11/1/91
PS/1FA/015	DoD Flight Information Publication, Planning	4	0	11/1/92
PS/1FA/015	DoD Flight Information Publication, Planning	4	AM 1	2/1/94
PS/1FA/015	DoD Flight Information Publication, Planning	4	AM 2	2/1/96
PS/1FA/020	DoD Flight Information Publication Flight Information Handbook	1	0	10/1/82
PS/1FA/020	DoD Flight Information Publication Flight Information Handbook	1	AM 1	4/1/91
PS/1FA/020	DoD Flight Information Publication Flight Information Handbook	1	AM 2	2/1/94
PS/1FA/020	DoD Flight Information Publication Flight Information Handbook	1	CN 1	3/1/83
PS/1FA/020	DoD Flight Information Publication Flight Information Handbook	1	CN 2	4/1/85
PS/1FA/020	DoD Flight Information Publication Flight Information Handbook	1	CN 3	12/1/86
PS/1FA/020	DoD Flight Information Publication Flight Information Handbook	1	CN 4	5/1/87
PS/1FA/025	DoD Flight Information Publication Enroute Supplement, Terminal High & Low Altitude Instrument Approach Procedures, Standard Instrument Departures, Radar Instrument Approach Minimums, Airport Diagrams, Africa and Eastern Europe and Asia	2	0	5/1/92
PS/1FA/025	DoD Flight Information Publication Enroute Supplement, Terminal High & Low Altitude Instrument Approach Procedures, Standard Instrument Departures, Radar Instrument Approach Minimums, Airport Diagrams, Africa and Eastern Europe and Asia	2	CN 1	8/1/94
PS/1FA/030	USAF Aircraft Surge Launch and Recovery Publication Terminal High and Low Altitude Instrument Approach Procedures	3	0	1/1/87
PS/1FA/050	DoD Flight Information Publication Area Arrival Chart Depicting Terrain Data	3	0	12/1/92
PS/1FA/050	DoD Flight Information Publication Area Arrival Chart Depicting Terrain Data	3	CN 1	6/1/94
PS/1FA/091	DoD Flight Information Publication Terminal (High Altitude) Instrument Approach Procedures Worldwide	3	0	7/1/90
PS/1FA/091	DoD Flight Information Publication Terminal (High Altitude) Instrument Approach Procedures Worldwide	3	AM 1	10/1/91
PS/1FA/091	DoD Flight Information Publication Terminal (High Altitude) Instrument Approach Procedures Worldwide	3	AM 2	5/1/92
PS/1FA/091	DoD Flight Information Publication Terminal (High Altitude) Instrument Approach Procedures Worldwide	3	AM 3	7/1/94
PS/1FA/091	DoD Flight Information Publication Terminal (High Altitude) Instrument Approach Procedures Worldwide	3	CN 1	10/1/95
PS/1FB/028	DoD Flight Information Publication GPA-30 Video Plates, GPA-131(FAA) 8970 Aero Video Charts	3	0	7/1/85
PS/1FD/009	FACELIFT	3	0	4/1/83
PS/1FD/086	Digital Aeronautical Flight Information File (DAFIF)	5	0	3/1/96
PS/1FF/026	Foreign Clearance Guide	1	0	6/1/87
PS/1GE/005	Automated Air Facilities Information File	2	0	2/1/97
PS/1GK/100	DMA Vertical Obstruction File (DVOF)	1	0	4/1/87
PS/2AA/011	Modified Facsimile Nautical Charts	3	0	3/1/84
PS/2AA/011	Modified Facsimile Nautical Charts	3	AM 1	7/24/85
PS/2AA/011	Modified Facsimile Nautical Charts	3	AM 2	7/29/88
PS/2AA/011	Modified Facsimile Nautical Charts	3	AM 3	4/3/89

Document Number	Document Title	Ed.	AM or CN*	Date
PS/2AA/011	Modified Facsimile Nautical Charts		APP 1	8/10/84
PS/2AA/011	Modified Facsimile Nautical Charts		APP 2	8/10/84
PS/2AA/011	Modified Facsimile Nautical Charts	3	CN 1	8/10/84
PS/2AA/011	Modified Facsimile Nautical Charts	3	CN 2	7/24/85
PS/2AA/011	Modified Facsimile Nautical Charts	3	CN 3	7/29/88
PS/2AA/011	Modified Facsimile Nautical Charts	3	CN 4	4/3/89
PS/2AA/011	Modified Facsimile Nautical Charts	3	CN 5	12/3/92
PS/2BD/040	Bottom Contour Charts	4	0	3/1/85
PS/2BD/040	Bottom Contour Charts	4	CN 1	11/27/89
PS/2BD/040	Bottom Contour Charts	4	CN 2	3/12/92
PS/2CA/010	Electronic Plotting Chart Bases	2	0	10/1/76
PS/2CA/010	Electronic Plotting Chart Bases	2	CN 1	12/3/92
PS/2DA/010	Naval Operating Area Chart	1	0	12/1/84
PS/2DA/010	Naval Operating Area Chart	1	CN 1	12/3/92
PS/2DA/013	Hull Integrity Test Site Charts (C)	2	0	12/1/84
PS/2DA/013	Hull Integrity Test Site Charts (C)	2	AM 1	6/4/85
PS/2DA/013	Hull Integrity Test Site Charts (C)	2	CN 1	12/3/92
PS/2DC/030	Position Plotting Sheets	1	0	8/1/78
PS/2DC/030	Position Plotting Sheets	1	CN 1	12/3/92
PS/2EE/051	LORAN-C Lattice Tables	1	0	3/1/84
PS/2EE/051	LORAN-C Lattice Tables	1	CN 1	12/3/92
PS/2EE/052	LORAN-C Secondary Phase Correction Table Pub 221	1	0	11/1/81
PS/2EE/052	LORAN-C Secondary Phase Correction Table Pub 221	1	CN 1	12/3/92
PS/2EF/060	OMEGA Lattice Tables	2	0	5/1/85
PS/2EF/060	OMEGA Lattice Tables	2	CN 1	12/3/92
PS/2EF/061-062	OMEGA Propagation Correction Tables	1	0	4/1/84
PS/2EF/061-062	OMEGA Propagation Correction Tables	1	CN 1	12/3/92
PS/2EG/073	Distances Between Ports	1	0	12/1/79
PS/2EG/073	Distances Between Ports	1	CN 1	12/3/92
PS/2EH/084	Sight Reduction Tables for Marine Navigation	1	0	11/1/79
PS/2EH/084	Sight Reduction Tables for Marine Navigation	1	CN 1	12/3/92
PS/2EH/085	Sight Reduction Tables for Air Navigation	1	0	3/1/80
PS/2EH/085	Sight Reduction Tables for Air Navigation	1	CN 1	12/3/92
PS/2EH/091	Maneuvering Board Manual	1	0	11/1/79
PS/2EH/091	Maneuvering Board Manual	1	CN 1	12/3/92
PS/2EH/093	Handbook of Magnetic Compass Adjustment	1	0	6/1/78
PS/2EH/093	Handbook of Magnetic Compass Adjustment	1	CN 1	12/3/92
PS/2EH/094	RADAR Navigation Manual	1	0	6/1/80
PS/2EH/094	RADAR Navigation Manual	1	CN 1	12/3/92
PS/3AC/101	Topo 50 Data Base	1	0	6/1/78
PS/3DB/401	International Map of the World	1	0	12/1/76
PS/3DB/403	Small Scale Road Maps	1	0	10/1/78
PS/3DB/403	Small Scale Road Maps	1	CN 1	11/21/80
PS/4AA/380	U.S. Air Target Chart, Series 200, (S)	2	0	1/1/81
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 1 (S)	2	AM 1	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 2 (S)	2	AM 1	

Document Number	Document Title	Ed.	AM or CN*	Date
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 1 (S)	2	AM 2	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 2 (S)	2	AM 2	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 1 (S)	2	AM 3	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 2 (S)	2	AM 3	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 1 (S)	2	AM 4	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 2 (S)	2	AM 4	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 1 (S)	2	AM 5	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 2 (S)	2	AM 5	
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 1 (S)		AM 6	6/1/89
PS/4AA/380	U.S. Air Target Chart, Series 200, Part 2 (S)	2	AM 6	1/26/90
PS/4AA/380	U.S. Air Target Chart, Series 200 (S)		STYLE SHEET	6/1/89
PS/4AA/380	U.S. Air Target Chart, Series 200 (S)		SYMBOL SHEET	6/1/89
PS/4AA-4AC/392	European Air Target Chart/European Joint Operations Graphic-RADAR	3	0	5/1/89
PS/4AB/312	Urban Area Mosaic Scale 1:25,000, 1:50,000	1	0	8/1/82
PS/4AD/200	Consolidated Air Target Materials Notices/Target Materials Bulletin, Volumes I and II (Classified)	1	0	7/1/85
PS/4CB/140	Joint Chiefs Of Staff Tactical Pilotage Charts	1	0	12/1/87
PS/4CB/140	Joint Chiefs Of Staff Tactical Pilotage Charts	1	CN 1	1/1/89
PS/4CB/141	Joint Chiefs Of Staff Operational Navigation Charts	1	0	5/1/88
PS/4CB/142	Joint Chiefs Of Staff Jet Navigation Charts	1	0	3/1/81
PS/4CB/143	SAC Special Jet Navigation Charts	1	0	2/1/81
PS/4EA/001	Point Target Ellipse	1	0	3/1/87
PS/4GD/300	Standard Terrain Roughness Overlays	1	0	5/1/87
PS/4GE-4GF-4GG/100	Terrain Contour Matching Matrix/Map Catalog	1	0	5/1/83
PS/4GE-4GF-4GG/100	Terrain Contour Matching (TERCOM) Data Base (S)	2	0	5/1/85
PS/4GE-4GF-4GG/100	Terrain Contour Matching (TERCOM) Data Base (S)	2	AM 1	2/5/98

* Note: AM = Amendment; CN = Change Notice

Appendix D: Acronyms

A

ABOR	Abort
ACP	Allied Communications Publication
AIG	Architecture Integration Group (NIMA)
ALE	Automated Link Establishment
AMS	Aeronautical Migration System
ANSI	American National Standards Institute
AOI	Area of Interest
API	Application Program Interface
AR	Architecture and Requirements Office (NIMA) [now SOS]
ARC	Equal Arc Second Raster Chart/Map
ARIDPCM	Adaptive Recursive Interpolated Differential Pulse Code Modulation
ARU	USIGS Architecture Division (NIMA) [now SOSE]
ASD	Assistant Secretary of Defense
ASD(C3I)	Assistant Secretary of Defense for Command, Control, Communications and Intelligence
ATC	Air Target Chart; Automatic Target Classification
ATD	Automatic Target Detection
ATM	Asynchronous Transfer Mode

B

BER	Bit Error Rate
BIIF	Basic Image Interchange Format
BIMA	Basic Imagery and Mapping Annotations
BNPC	Bathymetric Navigation Planning Chart
BOCA	Business Object Component Architecture
BOK	Base of Knowledge
BOOTP	Bootstrap Protocol
BRI	Basic Rate Interface
BUFR	Binary Universal Format for Representation

C

C2	Command and Control
C3I	Command, Control, Communications, and Intelligence
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CAD	Computer Aided Design/Drafting
CADRG	Compressed ARC Digitized Raster Graphics
CASE	Computer-Aided Software Engineering
CBR	Constant Bit Rate
CC	Common Client
CCITT	Comite Consultatif International de Telegraphique et Telephonique (International Telegraph and Telephone Consultative Committee) (now ITU-T)
CDE	Common Desktop Environment
CDL	Constraint Definition Language
CDM	Conceptual Data Model
CE	Circular Error
CFS	Center for Standards (DISA)
CGI	Computer Graphics Interface
CGM	Computer Graphics Metafile
CHAP	Challenge Handshake Authentication Protocol
CIA	Central Intelligence Agency
CIB	Controlled Image Base
CIL	Command Information Library
CINC	Commander in Chief
CIP	Common Imagery Processor

CMIP	Common Management Information Protocol
CNR	Combat Net Radio
COAS	Clinical Observations Access Service
COE	Common Operating Environment
COM	Common Object Model
CORBA	Common Object Request Broker Architecture
COTS	Commercial-off-the-Shelf
CPU	Central Processing Unit
CSA	Common Support Application
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
CSPE	Client/Server Processing Environment
CTRS	Conventional Terrestrial Reference System

D

DAFIF	Digital Aeronautical Flight Information File
DAMA	Demand Assigned Multiple Access
DARO	Defense Airborne Reconnaissance Office
DBDB	Digital Bathymetric Data Base
DBMS	Database Management System
DCAFE	Data Capture and Finishing Environment
DCE	Distributed Computing Environment
DCOM	Distributed Component Object Model
DDDS	Defense Data Dictionary System
DE	Dissemination Element
DFLIP™	Digital Flight Information Publication
DGIWG	Digital Geographic Information Working Group
DIA	Defense Intelligence Agency
DICOM	Digital Imaging and Communications in Medicine
DIGEST	Digital Geographic Information Exchange Standard
DII	Defense Information Infrastructure; Dynamic Invocation Interface
DIS	Draft International Standard
DISA	Defense Information Systems Agency
DISAC	Defense Information Systems Agency Circular
DISN	Defense Information System Network
DMTD	Digital Message Transfer Device
DNC™	Digital Nautical Chart
DNS	Domain Name Service
DNS	Domain Name System
DoC	United States Department of Commerce
DOC	Distributed Object Computing
DoD	United States Department of Defense
DoE	United States Department of Energy
DoI	United States Department of the Interior
DoJ	United States Department of Justice
DoT	United States Department of Transportation
DPDW	Digital Products Data Warehouse
DPPDB	Digital Point Positioning Data Base
DPS	Digital Production System
DSN	Defense Switched Network
DSOM	Distributed System Object Model
DSS1	Digital Subscriber Signaling System No. 1
DTED	Digital Terrain Elevation Data
DTOP™-MEDS	Digital Topographic Data - Mission Essential Data Set
DVOF	DMA Vertical Obstruction File

E

EAC	Echelons above Corps
EARS	Exploitation and Reporting Structure
EBU	European Broadcasting Union
ECDIS	Electronic Chart Display and Information System
EEI	External Environment Interface
EO	Electro-Optical
EPA	Environmental Protection Agency
EPD	Equal Probability of Detection
EPS	Enhanced Processing Segment

ES	Extension Segment

F

FAA	Federal Aviation Administration
FACC	Feature and Attribute Coding Catalog
FAS	Feature Analysis Services
FDMA	Frequency Division Multiple Access
FEMA	Federal Emergency Management Agency
FGS	Feature Generalization Services
FIPS	Federal Information Processing Standard
FPE	Front-end Processing Environment
FTP	File Transfer Protocol
FTR	Federal Telecommunications Recommendation
FY	Fiscal Year

G

GAP	Gridded Airfield Photograph
GAS	Geospatial Annotation Services
GCTS	Geospatial Coordinate Transformation Services
GDAS	Geospatial Domain Access Services
GDS	Geospatial Display Services
GFLOPS	Giga (one billion) Floating Point Operations per Second
GFMS	Geospatial Feature Manipulation Services
GIAS	Geospatial and Imagery Access Services
GIES	Geospatial Information Extraction Services
GIF	Graphics Interchange Format
GIP	Gridded Installation Photograph
GIS	Geographic Information System
GIXS	Geospatial and Imagery eXploitation Services
GOA	Generic Open Architecture
GOTS	Government Off-the-Shelf
GPC	Geospatial Production Cell
GPS	Global Positioning System
GRIB	Gridded Binary
GSMS	Geospatial Symbol Management Services

H

HAC	Harbor and Approach Chart
HCI	Human/Computer Interface
HDIF	Healthcare Data Interpretation Facility
HF	High Frequency
HL7	Health Level Seven
HSI	Hyperspectral Imagery
HTI	Human Technology Interface
HTML	Hypertext Markup Language
HYSAS	Hydrographic Source Assessment System

I

I&RTS	Integration and Runtime Specification
IAS	Information Access Services
IC	Intelligence Community
ICAM	Integrated Computer-Aided Manufacturing
ICD	Interface Control Document
IDEF0	Integration Definition for Function Modeling
IDEF1X	Integration Definition for Information Modeling
IDL	Interface Definition Language
IEC	Integrated Exploitation Capability; International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IES	Imagery Exploitation Services
IESS	Imagery Exploitation Support System
IETF	Internet Engineering Task Force
IGC	Imagery & Geospatial Community
IGMS	Image Geometry Model Services
IHO	International Hydrographic Organization
IIOP	Internet Inter-Orb Protocol
IISS	Integration Information Support System
IMGS	Image Map Generation Services
IMS	Imagery Manipulation Services

IP	Internet Protocol
IPC	Integrated Production Cell
IPCP	Internet Protocol Control Protocol
IPL	Image Product Library
IPL	Image Product Library
IR	Infra-red
IS	International Standard
ISDN	Integrated Services Digital Network
ISI	Information Services Interface
ISO	International Organization for Standardization
ISO	International Organization for Standardization
ISP	International Standardized Profile
ISR	Intelligence, Surveillance, and Reconnaissance
ISS	Image Synthesis Services
IT	Information Technology
ITU	International Telecommunications Union
ITU-R	International Telecommunications Union - Radiocommunication Sector
ITU-T	International Telecommunications Union - Telecommunication Standardization Sector (formerly CCITT)
IUS	Image Understanding Services

J

JDK	Java Development Kit
JFIF	JPEG File Interchange Format
JMTK	Joint Mapping Tool Kit
JNC	Jet Navigation Chart
JOG A/G	Joint Operations Graphic - Air/Ground
JOG R	Joint Operations Graphic - Radar
JPEG	Joint Photographic Experts Group
JPUB	Joint Publication
JTA	Joint Technical Architecture
JTC1	Joint Technical Committee 1 (ISO/IEC)
JTF	Joint Task Force

K

KMP	Key Management Protocol

L

LAN	Local Area Network
LCF	Log Control Function
LCP	Link Control Protocol
LDAP	Lightweight Directory Access Protocol
LD-CELP	Low-Delay Code Excited Linear Prediction
LDR	Low Data Rate
LE	Linear Error
LF	Low Frequency
LQM	Link Quality Monitoring
LSD	Local Slope Data
LUT	Look Up Table
LWD™	Littoral Warfare Data

M

MAA	Mission Area Application
MAC	Medium Access Control
MAF	Mobile Agent Facility (now called Mobile Agent System Interoperability Facilities)
MAS	Military Agency for Standardization
MAU	Medium-Access Unit
Mbits/s	Megabits per second
Mbps	Megabits per second
MC&G	Mapping, Charting, & Geodesy
MCG&I	Mapping, Charting, Geodesy, and Imagery
MDR	Medium Data Rate
MHz	Megahertz
MIL-HDBK	Military Handbook
MILSATCOM	Military Satellite Communications
MIL-STD	Military Standard
MINT	Multi-source Intelligence Toolkit
MLPP	Multi-Level Precedence and Preemption
MLS	Multilevel Security
MOA	Memorandum of Agreement

MOF	Meta Object Facility
MPEG	Motion Pictures Expert Group
MSA	Mission Specific Application
MSI	Multispectral Imagery

N

NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NCCB	NIMA Configuration Control Board
NCMP	NIMA Configuration Management Plan
NES	NIMA Exploitation System
NIC	Network Information Center
NIDR	Networked Information Discovery and Retrieval
NIL	National Information Library
NIMA	National Imagery and Mapping Agency
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard
NL	NIMA Library
NNI	Network-to-Network Interface
NNPP	NIMA NITFS Program Plan
NNSS	Navy Navigation Satellite System
NORAD	North American Aerospace Defense Command
NPC	NIMA Production Cell
NRO	National Reconnaissance Office
NSA	National Security Agency
NSIF	NATO Secondary Imagery Format
NTB	NITFS Technical Board
NTM	National Technical Means

O

OA&D	Object Analysis and Design
OA&DF	Object Analysis and Design Facility
ODBC	Open Data Base Connectivity
ODP	Open Distributed Processing
OGC	Open GIS Consortium, Inc.
OLE	Object Linking and Embedding
OLTP	On-Line Transaction Processing
OMA	Object Management Architecture
OMG	Object Management Group
OMT	Object Modeling Technique
ONC	Operational Navigation Chart
OOSE	Object-Oriented Software Engineering
ORB	Object Request Broker
OSD	Office of the Secretary of Defense
OSF	Open Software Foundation (now part of The Open Group)
OSI	Open System Interconnection

P

PAS	Publicly Available Specification
PASV	Passive
PDM	Product Data Management
PEO	Program Executive Officer
PIAE	Profile for Imagery Access Extensions
PICS	Protocol Implementation Conformance Statement
PID	Program Implementation Document
PIDS	Patient Identification Service
PIKS	Programmer's Imaging Kernel System
POS	Persistent Object Service
POSIX	Portable Operating Systems Interface
POSIX	Portable Operating System Interface
PPDB	Point Positioning Data Base
PRI	Primary Rate Interface
PSK	Phase Shift Keying
PTADB	Planning Terrain Analysis Data Base

R

R&D	Research and Development
RFC	Request for Comment
RFI	Request for Information
RFP	Request for Proposal

RM	Reference Model
RMI	Remote Method Invocation
RM-ODP	Reference Model for Open Distributed Processing
RPC	Remote Procedure Call
RPF	Raster Product Format
RTAD	Relocatable Target Assessment Data

S

SAR	Synthetic Aperture Radar
SCI	Sensitive Compartmented Information
SCSI	Small Computer System Interface
SDE	Support Data Extension
SDNS	Secure Data Network System
SDTS	Spatial Data Transfer Standard
SGML	Standard Generalized Markup Language
SHADE	Shared Data Environment
SHF	Super High Frequency
SIDR	Secure Intelligence Data Repository
SIDS	Secondary Imagery Dissemination System
SIEM	System Information Exchange Matrix
SLF	Standard Linear Format
SMIF	Stream-based Model Interchange Format
SMPTE	Society of Motion Picture and Television Engineers
SMTP	Simple Mail Transfer Protocol
SOM	System Object Model
SOS	Systems Engineering & Integration Division (NIMA)
SOSE	Engineering Branch (NIMA)
SOW	Statement of Work
SP3	Security Protocol 3
SPIA	Standards Profile for Imagery Access
SPID	Standards Profile for Imagery Distribution
SPOT	Satellite pour l'Observation de la Terre
SQL	Structured Query Language
ST/T	Systems and Technology Directorate Technology Office (NIMA)
STANAG	Standardization Agreement
STOU	Store Unique
SW	Software

T

TACO2	Tactical Communications Protocol 2
TADIL	Tactical Digital Information Link
TAFIG	Technical Architecture Framework and Implementation Guidance
TAFIM	Technical Architecture Framework for Information Management
TBD	To Be Determined
TBR	To Be Resolved
TC	Technical Committee
TCP	Transmission Control Protocol
TDMA	Time Division Multiple Access
TED	Triteal Enterprise Desktop
TELNET	Telecommunications Protocol
TERCOM	Terrain Contour Matching
TFTP	Trivial File Transfer Protocol
TIFF	Tagged Image File Format
TIN	Triangulated Irregular Network
TLM	Topographic Line Map
TMN	Telecommunications Management Network
TOD™	Tactical Ocean Data
TPC	Tactical Pilotage Chart
TRM	Technical Reference Model
TTADB	Tactical Terrain Analysis Data Base

U

UAF	USIGS Architecture Framework
UCDM	USIGS Conceptual Data Model (synonym for USIGS/CDM)
UDP	User Datagram Protocol
UHF	Ultra High Frequency
UIP	USIGS Interoperability Profile

UK	United Kingdom of Great Britain and Northern Ireland
UML	Unified Modeling Language
UOAD	USIGS Operational Architecture Description
UPS	Universal Polar Stereographic
URL	Uniform Resource Locator
US	United States
USD(A&T)	Office of the Under Secretary of Defense for Acquisition and Technology
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USIGS	United States Imagery and Geospatial Information System
USIGS/CDM	United States Imagery and Geospatial Information System Conceptual Data Model
USIS	United States Imagery System
USMTF	United States Message Text Format
UTA	USIGS Technical Architecture
UTAP	USIGS Technical Architecture Profile
UTM	Universal Transverse Mercator
UVMap™	Urban Vector Smart Map

V

VFR	Visual Flight Rules
VHF	Very High Frequency
VISP	Video Imagery Standards Profile
VITD	VPF Interim Terrain Data
VLF	Very Low Frequency
VMap™	Vector Smart Map
VMap 0™	Vector Smart Map Level 0
VMap 1™	Vector Smart Map Level 1
VMap 2™	Vector Smart Map Level 2
VMF	Variable Message Format
VPF™	Vector Product Format
VPPDB	Video Point Positioning Data Base
VQ	Vector Quantization
VRF	Vector Relational Format
VSAT	Very Small Aperture Terminal
VTC	Video Teleconferencing
VVOD™	Vector Vertical Obstruction Data

W

W3C	World Wide Web Consortium
WGS	World Geodetic System
WMED	World Mean Elevation Data
WMM	World Magnetic Model
WMO	World Meteorological Organization
WVS+	World Vector Shoreline Plus (synonym for WVS*PLUS*™)
WVS*PLUS*™	World Vector Shoreline Plus

X

XCMF	X/Open-based Common Management Facilities
XSM	X/Open System Management

Y

Y2K	Year 2000

For a more complete set of USIGS acronyms, see the USIGS Glossary [Ugloss98].

This Page Intentionally Left Blank

Appendix E: USIGS Glossary Extract

The definitions presented in this appendix are architectural terms of reference extracted from the USIGS Glossary [Ugloss98]. They are intended to assist in understanding the architecture, reference model, and standards discussions in the sections of this document.

application
The use of capabilities provided by an information system specific to the satisfaction of a set of user requirements. Note: These capabilities include hardware, software, and data. [IEEE P1003.0]

application platform [entity]
1) A set of resources, including hardware and software, that support the services on which application software will run. The application platform provides services at its interfaces that, as much as possible, make the specific characteristics of the platform transparent to the application software. [IEEE P1003.0]
2) The collection of hardware and software components that provide the services used by support and mission-specific software applications. [TAFIM 3.0]

application program interface (API)
The interface between the application software and the application platform, across which all services are provided. [IEEE P1003.0]

application software
Software that is specific to an application and is composed of programs, data, and documentation. [IEEE P1003.0]

architectural framework
Identifies key interfaces and services, and provides a context for identifying and resolving policy, management and strategic technical issues. Constrains implementation by focusing on interfaces, but does not dictate design or specific technical solutions. [OpenGIS Guide]

architecture
Architecture has various meanings, depending upon its contextual usage. (a) The structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time. (b) Organizational structure of a system or component. An architecture is a composition of (1) components (including humans) with their functionality defined (Technical), (2) requirements that have been configured to achieve a prescribed purpose or mission (Operational), and (3) their connectivity with the information flow defined (System). [JTA]

architecture of a system
A set of rules that define the structure of a system and inter-relationships between its parts. [RM-ODP]

architecture views
See **views, architecture**.

Common Facilities {CORBA}
Facilities useful in many application domains and which are made available through OMA- [Object Management Architecture-] compliant class interfaces. **[**OMA Guide]

Common Object Request Broker Architecture (CORBA)
1) An architecture that enables pieces of programs, called objects, to communicate with one another regardless of what programming language they were written in or what operating system they're running on. CORBA was developed by an industry consortium known as the Object Management Group (OMG). There are several implementations of CORBA, the most widely used being IBM's SOM [System Object Model] and DSOM [Distributed System Object Model] architectures. CORBA has also been embraced by Netscape as part of its Netscape ONE (Open Network Environment) platform. Two competing models are Microsoft's COM [Common Object Model]and DCOM [Distributed Common Object Model] and Sun Microsystems' RMI [Remote Method Invocation]. [PC Webopaedia]
2) An ORB standard endorsed by the OMG (Object Management Group). An ORB is software that handles the communication of messages between objects in a distributed, multi-platform environment. [Freedman 1995]

Common Operating Environment (COE)
See **Defense Information Infrastructure Common Operating Environment (DII COE).**

Common Support Application (CSA)
CSAs provide the architectural framework for managing and disseminating information flow throughout the system, and for sharing information among applications. CSAs contain facilities for processing and displaying common data formats and for information integration and visualization. [DII COE I&RTS]

component
A stand-alone 'object' that is not bound to a particular program, computer language, or implementation. It is not a complete application, but can be used to build cheap, personalized applications [Shah 1996]

conceptual data model
The relationship and definitions of all data that is used by and influences the other three architecture components – operational, systems, and technical. [UAF-B]

Defense Information Infrastructure Common Operating Environment (DII COE)
The DII COE establishes an integrated software infrastructure which facilitates the migration and implementation of functional mission applications and integrated databases across information systems in the Defense Information Infrastructure (DII). The DII COE provides architecture principles, guidelines, and methodologies that assist in the
development of mission application software by capitalizing on a thorough, cohesive set of infrastructure support services. [DII MP]

Department of Defense Joint Technical Architecture (DoD JTA)
A DoD document designed to provide the minimum set of standards that, when implemented, permit the flow of information in support of the Warfighter. The DoD JTA:

- provides the foundation for interoperability among all tactical, strategic, and combat support services systems;
- mandates the standards and guidelines for system development and acquisition that will significantly reduce cost, development time and fielding time for improved systems, while minimizing the impact on system performance wherever possible;
- communicates to industry DoD's intent to use open systems products and implementations;
- reflects the direction of industry's standards-based product development so that today's emerging technologies can be more readily leveraged by tomorrow's military systems. [JTA]

distributed computing
A type of computing in which different components and objects comprising an application can be located on different computers connected to a network. So, for example, a word processing application might consist of an editor component on one computer, a spell-checker object on a second computer, and a thesaurus on a third computer. In some distributed computing systems, each of the three computers could even be running a different operating system. Distributed computing is a natural outgrowth of object-oriented programming. Once programmers began creating objects that could be combined to form applications, it was a natural extension to develop systems that allowed these objects to by physically located on different computers. One of the requirements of distributed computing is a set of standards that specify how objects communicate with one another. There are currently two chief distributed computing standards: CORBA and DCOM. [PC Webopaedia]

distributed processing
1) Also called **distributed computing**, it is a system of computers connected by a communications network. The term is used loosely to refer to any computers with communications between them. However, in true distributed processing, each computer system is sized to handle its local workload, and the network has been designed to support the system as a whole. [Freedman 1995]
2) Information processing in which discrete components may be located in different places, and where communication between components may suffer delay or may fail. [RM-ODP]

domain
1) A distinct functional area that can be supported by a family of systems with similar requirements and capabilities. An area of common operational and functional requirements. [JTA]
2) A concept important to interoperability, it is a distinct scope, within which common characteristics are exhibited, common rules observed, and over which a distribution transparency is preserved. [CORBA 2.2]
3) System context: A class of systems which have similar requirements and capabilities. Application context: The body of knowledge defining the range and scope of an application in terms of elements, rules and behaviors. [OpenGIS Guide]
4) A set of objects, each of which is related by a characterizing relationship, to a controlling object. Every domain has a controlling object associated with it. Examples of domains are: Security domains and Management domains. [RM-ODP]

emerging standard
A specification that is under consideration by an accredited standards development organization, but that has not completed the process of approval by the sponsoring body. Emerging standards are often subject to significant change prior to approval. [IEEE P1003.0]

entity
1) Representation of a collection of data elements in a conceptual schema. [ISO/TC 211]
2) Class of objects with common properties. [ISO/TC 211]
3) Any concrete or abstract thing of interest. While in general the word entity can be used to refer to anything, in the context of modeling it is reserved to refer to things in the universe of discourse being modeled. [RM-ODP]

facility
A collection of object services, with additional functionality, that is used for a specific purpose. [UTA]

framework
A reusable software template, or skeleton, from which key enabling and supporting services can be selected, configured, and integrated with application code. [OpenGIS Guide] See also **architectural framework**.

framework {object-oriented}
In object-oriented programming, a generalized subsystem design for building applications. It consists of abstract classes and their object collaboration as well as concrete classes. While object-oriented programming supports software reuse, frameworks support design reuse. [Freedman 1995]

Imagery & Geospatial Community (IGC)
The composition of cooperating commands, services, agencies, and departments within the United States Government, foreign governments, and private sector organizations involved in the acquisition, production and exploitation, and dissemination of imagery, imagery intelligence, and geospatial information. The IGC fosters extensive partnerships with others, including commercial and academic institutions, to collaboratively work together to share information. [NIMA SP]

infrastructure
Infrastructure is used with different contextual meanings. Infrastructure most generally relates to and has a hardware orientation, but note that it is frequently more comprehensive and includes software and communications. Collectively, the structure must meet the performance requirements of and capacity for data and application requirements. Again note that just citing standards for designing an architecture or infrastructure does not include functional and mission area requirements for performance. Performance requirement metrics must be an inherent part of an overall infrastructure to provide performant interoperability and compatibility. It identifies the top-level design of communications, processing, and operating system software. It describes the performance characteristics needed to meet database and application requirements. It provides a geographic distribution of components to locations. The infrastructure architecture is defined by the service provider for these capabilities. It includes processors, operating systems, service software, and standards profiles that include network diagrams

showing communication links with bandwidth, processor locations, and capacities to include hardware builds versus schedule and costs. [TAFIM 3.0]

interface
1) A listing of the operations and attributes that an object provides. This includes the signatures of the operations, and the types of the attributes. An interface definition ideally includes the semantics as well. An object satisfies an interface if it can be specified as the target object in each potential request described by the interface. [CORBA 2.2]
2) A connecting link or interrelationship between two systems, two devices, two applications, or the user and an application, device, or system. In the OSI [Open Systems Interconnection] Reference Model, it is the boundary between adjacent layers. [TAFIM 3.0]
3) (a) A shared boundary across which information is passed. (b) A hardware or software component that connects two or more components for the purpose of passing information from one to the other. (c) To connect two or more components for the purpose of passing information from one to the other. (d) To serve as a connecting or connected component as in (a). [IEEE 610.12]
4) A shared boundary between two functional entities. A standard specifies the services in terms of the functional characteristics and behavior observed at the interface. The standard is a contract in the sense that it documents a mutual obligation between the service user and provider and assures stable definition of that obligation. [IEEE P1003.0]

interoperability
1) The ability for a system or components of a system to provide information portability and interapplication, cooperative process control. [OpenGIS Guide]
2) (a) The ability of two or more systems or components to exchange and use information. (b) The ability of systems to provide and receive services from other systems and to use the services so interchanged to enable them to operate effectively together. [TOGAF 3]
3) The ability of the systems, units, or forces to provide and receive services from other systems, units, or forces, and to use the services so interchanged to enable them to operate effectively together. The conditions achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. [JPUB 1-02]

interoperability {CORBA}
The ability for two or more ORBs to cooperate to deliver requests to the proper object. Interoperating ORBs appear to a client to be a single ORB. [CORBA 2.2]

interoperability {DII COE}
The ability of two or more systems or components to exchange and use information (IEEE STD 610.12). This definition is extended in the context of a COE to include levels of interoperability, and relate interoperability to interfacing (lowest, least desirable level) versus true integration (highest, most desirable level). [DII COE I&RTS]

Joint Technical Architecture (JTA)
See **Department of Defense Joint Technical Architecture (DoD JTA)**.

Mission Area Application (MAA)
Mission area applications implement specific end-user requirements or needs (e.g., payroll, accounting, materiel management, personnel, control of real-time systems, analysis of order of battle). [TAFIM 3.0]

object request broker (ORB)
Provides the means by which clients make and receive requests and responses. [CORBA 2.2] See also **Common Object Request Broker Architecture (CORBA)**.

open system
1) A system that implements sufficient open specifications for interfaces, services, and supporting formats to enable properly engineered components to be utilized across a wide range of systems with minimal changes, to interoperate with other components on local and remote systems, and to interact with users in a style that facilitates portability. An open system is characterized by the following:

- well defined, widely used, non-proprietary interfaces/protocols, and
- use of standards which are developed/adopted by industrially recognized standards bodies, and
- definition of all aspects of system interfaces to facilitate new or additional systems capabilities for a wide range of applications, and
- explicit provision for expansion or upgrading through the incorporation of additional or higher performance elements with minimal impact on the system. [JTA]

2) A system that implements sufficient open specifications or standards for interfaces, services, and supporting formats to enable properly engineered application software

- to be ported with minimal changes across a wide range of systems from one or more suppliers;
- to interoperate with other applications on local and remote systems;
- to interact with people in a style that facilitates user portability. [IEEE P1003.0]

operational architecture view
The operational architecture view is a description of the tasks and activities, operational elements, and information flows required to accomplish or support a military operation. It contains descriptions (often graphical) of the operational elements, assigned tasks and activities, and information flows required to support the warfighter. It defines the type of information, the frequency of exchange, which tasks and activities are supported by the information exchanges, and the nature of information exchanges in detail sufficient to ascertain specific requirements. [C4ISR AF]

platform
1) Computer hardware, including microcomputers, workstations, and mainframe computers, or for underlying software, like an operating system, that provides services to layered software. When discussing software, platform independence implies the software can be run on any computer. [OpenGIS Guide]
2) The entity of the Technical Reference Model that provides common processing and communication services that are provided by a combination of hardware and software and are required by users, mission area applications, and support applications. [TAFIM 3.0]

profile of a standard
The tailoring of a standard to satisfy a specified need. Tailoring is accomplished by selecting a subset of the standard or by selecting options within the standard. A profile is selected to apply across an application area of a standard rather than across a single application. [USIS 95] Contrast with **profile, standards.**

profile, standards
A set of one or more base standards, and, where applicable, the identification of chosen classes, subsets, options, and parameters of those base standards, necessary for accomplishing a particular function. [IEEE P1003.0] Contrast with **profile of a standard.**

public specifications
Specifications that are available, without restriction, to anyone for implementation, sublicensing, and distribution (i.e., sale) of that implementation. [IEEE P1003.0]

reference model
1) A reference model is a generally accepted abstract representation that allows users to focus on establishing definitions, building common understandings and identifying issues for resolution. Reference models provide a mechanism for identifying key issues associated with portability, scalability, and interoperability. [JTA]
2) A structured collection of concepts and their relationships that scope a subject and enable the partitioning of the relationships into topics relevant to the overall subject and that can be expressed by a common means of description. [IEEE P1003.0]

service
1) A function that is common to a number of programs, such as performing some extensive calculation or retrieving a category of data. An example of a service is a function that accepts a request to transform a point from one coordinate system into another. [DII COE I&RTS]
2) A distinct part of the functionality that is provided by an entity on one side of an interface to an entity on the other side of the interface. [IEEE P1003.0]

service area
A set of capabilities grouped into categories by function. The JTA defines a set of services common to DoD information systems. [JTA]

standard
1) A document, established by consensus and approved by an accredited standards development organization, that provides, for common and repeated use, rules, guidelines, or characteristics for activities or their results, aimed at the achievement of the optimum degree of order and consistency in a given context. [IEEE P1003.0]
2) A document that establishes uniform engineering and technical requirements for processes, procedures, practices, and methods. Standards may also establish requirements for selection, application, and design criteria of material. [JTA]

standard (IT)
IT standards provide technical definitions for information system processes, procedures, practices, operations, services, interfaces, connectivity, interoperability, information formats, information content, interchange and transmission/transfer. IT standards apply during the development, testing, fielding, enhancement, and life-cycle maintenance of DoD information systems. IT standards include non-government national or international standards, Federal standards, military standards, and multinational treaty organization standardization agreements. They may take numerous forms including standards, handbooks, manuals, specifications, commercial item descriptions, standardized drawings, all referred to collectively here as standards. [DISA CFS]

standardized profile
A balloted, formal, harmonized document that specifies a profile. [IEEE P1003.0]

standards profile
See **profile, standards**.

system
1) (a) People, machines and methods organized to accomplish a set of specific functions. (b) An integrated composite of people, products, and processes that provides a capability or satisfy a stated need or objective. [JTA]
2) A collection of components organized to accomplish a specific function or set of functions. [IEEE 610.12]
3) Something of interest as a whole or as comprised of parts. Therefore a system may be referred to as an entity. A component of a system may itself be a system, in which case, it may be called a subsystem. For modeling purposes, the concept of a system is understood in its general, system-theoretic sense. The term “system” can refer to an information processing system but can also be applied more generally. [RM-ODP]
4) A set of different elements so connected or related as to perform a unique function not performable by the elements alone. The most important and distinguishing characteristic of a system, therefore, is the relationships among the elements. [DII COE I&RTS]

systems architecture view
The systems architecture view is a description, including graphics, of systems and interconnections providing for, or supporting, warfighting functions. For a domain, the systems architecture view shows how multiple systems link and interoperate, and may describe the internal construction and operations of particular systems within the architecture. For the individual system, the systems architecture view includes the physical connection, location, and identification of the key nodes (including materiel item nodes), circuits, networks, warfighting platforms, etc., and specifies system and component performance parameters (e.g., mean time between failure, maintainability, availability). The systems architecture view associates physical resources and their performance attributes to the operational view and its requirements per standards defined in the technical architecture. [C4ISR AF]

technical architecture view
The technical architecture view is the minimal set of rules governing the arrangement, interaction, and interdependence of system parts or elements, whose purpose is to ensure that a conformant system satisfies a specified set of requirements. The technical architecture view provides the technical systems-implementation guidelines upon which engineering specifications are based, common building blocks are established, and product lines are developed. The technical architecture view includes a collection of the technical standards, conventions, rules and criteria organized into profile(s) that govern system services, interfaces, and relationships for particular systems architecture views and that relate to particular operational views. [C4ISR AF]

Technical Reference Model (TRM) {DoD}
A target framework and profile of standards for the DoD computing and communications infrastructure. [JTA] See also **reference model.**

United States Imagery and Geospatial Information System (USIGS)
The extensive network of systems used by the Department of Defense (DoD) and the Intelligence Community that share and exploit imagery, imagery intelligence, and geospatial information. These systems provide capabilities involved with the integrated information management, collection, production, exploitation, dissemination and archive, and infrastructure of this information. Organizations which have some level of interface with USIGS, but are not part of DoD and the Intelligence Community, are considered participants in USIGS if they adhere to the technical and system standards. [NIMA SP]

user
(a) Any person, organization, or functional unit that uses the services of an information processing system. (b) In a conceptual schema language, any person or any thing that may issue or receive commands and messages to or from the information system. [TAFIM 3.0]

views, architecture
Perspectives that logically combine to describe an architecture. [C4ISR AF] See **operational architecture view; systems architecture view; technical architecture view.** See also **conceptual data model.**

This Page Intentionally Left Blank

Appendix F: References

[C4ISR97] Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Architecture Working Group (AWG), *C4ISR Architecture Framework*, Version 2.0, 18 December 1997 (see web site http://www.cisa.osd.mil/).

[COE97] Defense Information Systems Agency, Joint Interoperability and Engineering Organization, *Defense Information Infrastructure (DII) Common Operating Environment (COE) Baseline Specifications*, Version 3.1, CM-400-25-07, 29 April 1997.

[CORBA97a] Object Management Group, *The Common Object Request Broker: Architecture and Specification*, Revision 2.0, OMG document formal/97-02-25.

[CORBA97b] Object Management Group, *CORBAfacilities Architecture Specification*, OMG document formal/98-07-10 (see web site http://www.omg.org/library/specindx.html).

[CORBA97c] Object Management Group, *CORBAservices Specification*, OMG document formal/98-07-05 (see web site http://www.omg.org/library/specindx.html).

[CORBA97d] Object Management Group, *The Common Object Request Broker: Architecture and Specification*, Revision 2.1, OMG document formal/97-09-01.

[CORBA98] Object Management Group, *The Common Object Request Broker: Architecture and Specification*, Revision 2.2, OMG document formal/98-07-01, July 1998 (see web site http://www.omg.org/library/specindx.htm).

[GIAS98] National Imagery and Mapping Agency, *Geospatial and Imagery Access Services Specification*, Version 3.2, 28 July 1998 (see web site http://www.nima.mil/aig/).

[GIXS98] National Imagery and Mapping Agency, *Geospatial and Imagery eXploitation Services Specification*, Draft Version 0.7, 5 June 1998.

[I&RTS97] Defense Information Systems Agency, Joint Interoperability and Engineering Organization, *DII COE Integration & Runtime Specification*, Version 3.0, July 1997.

[JTA98] Department of Defense, *Joint Technical Architecture*, Version 2.0, 26 May 1998 (see web site http://www-jta.itsi.disa.mil/).

[NBP97] National Imagery and Mapping Agency, *NIMA Business Plan*, 1997 (see web site http://www.nima.mil/general/business_plan/cover.html)

[NIMA96] Department of Defense, DoD Directive 5105.60, *National Imagery and Mapping Agency (NIMA)*, October 11, 1996.

[NIMA97] National Imagery and Mapping Agency, *R&D Strategic Thrusts: FY96 Imagery & Geospatial Technology Baseline*, 6 June 1997.

[NJIP97] *National Imagery and Mapping Agency Implementation Plan for the Department of Defense Joint Technical Architecture*, October 1997. Note: Cover memorandum, titled: 'National Imagery and Mapping Agency Implementation of the Department of Defense Joint Technical Architecture (JTA),' signed by DD/ST on 7 November 1997

[NSP97] National Imagery and Mapping Agency, *NIMA Strategic Plan 1997* (see web site http://www.nima.mil/publications/StratPlan-web/index.html)

[OMG97] Object Management Group, *A Discussion of the Object Management Architecture*, January 1997 (see web site http://www.omg.org/library/omaa.htm).

[PID98] National Imagery and Mapping Agency, *Program Implementation Document* (PID), RFC N01-0045, 28 July 1998.

[SPID95] *USIS Standards Profile for Imagery Distribution* (SPID), Version 1, 13 October 1995.

[TAFIG94] *Technical Architecture Framework and Implementation Guidance* (TAFIG), Version 1.0, Defense Mapping Agency, 28 Oct 1994.

[TAFIM96] Defense Information Systems Agency, Center for Standards, *Department of Defense Technical Architecture Framework for Information Management*, 8 Volumes, Version 3.0, 30 April 1996.

[UAF98] National Imagery and Mapping Agency (NIMA) Architecture and Requirements Office (AR), *USIGS Architecture Framework*, Revision B, 23 June 1998 (see web site http://www.nima.mil/aig/).

[Ugloss98] National Imagery and Mapping Agency (NIMA) Architecture and Requirements Office (AR), *USIGS Glossary*, Revision A, 24 November 1998 (see web site http://www.nima.mil/aig/).

[UIP98] National Imagery and Mapping Agency (NIMA) Architecture and Requirements Office (AR), *USIGS System Architecture Volume II: USIGS Interoperability Profile* (UIP), USIGS 1.5 Baseline, USIGS 2.0/2.5 Preliminary Baseline, 24 November 1998 (see web site http://www.nima.mil/aig/).

[Usec97] National Imagery and Mapping Agency (NIMA) Architecture and Requirements Office (AR), *USIGS Security Component*, 30 September 1997.

[USIS95] Central Imagery Office, *USIS Standards and Guidelines*, Version 1, CIO 2008, 13 October 1995, as revised by Change Letters 1 and 2.

[UTA97] National Imagery and Mapping Agency (NIMA) Architecture and Requirements Office (AR), *NIMA USIGS Technical Architecture*, NIMA S1020100, 6 November 1997.

Index

Addendum: UTA Standards Summary and Compliance Checklist

The Addendum is published under separate cover.

This Page Intentionally Left Blank